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July. 1935 No. 68 20c in U. S. A.

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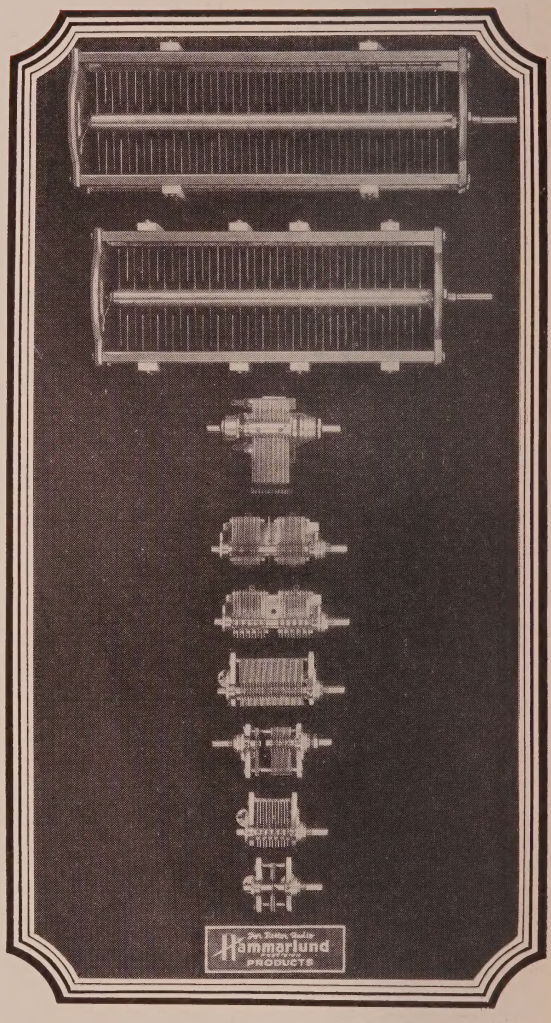

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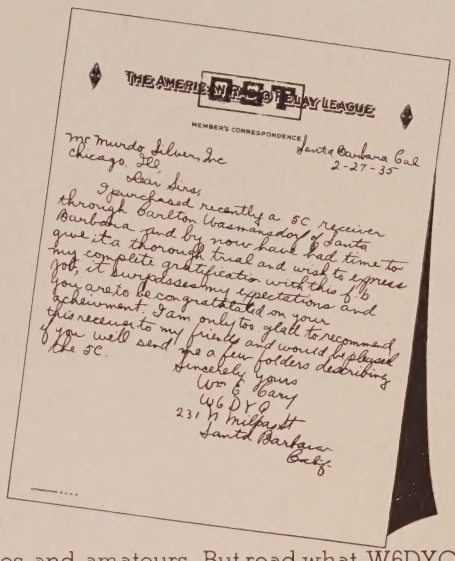
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achievment. I am only too glad to recommend
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if you will send me a few folders describing
the 5C.
Sincerely Yours
Wm E Leary
W6DYQ
231 N Milpas St
Santa Barbara
Calif

We still believe that more 5C professional superheterodynes have gone into amateur stations in the last six months than have any other commercial superhets—at least, so our sales tell us. There must be a reason for this condition—and there is—performance plus. Ask anybody you work why he reports you R9 and we'll bet that once out of every three times a 5C in his shack will be the answer.

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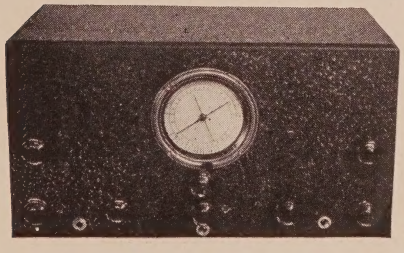

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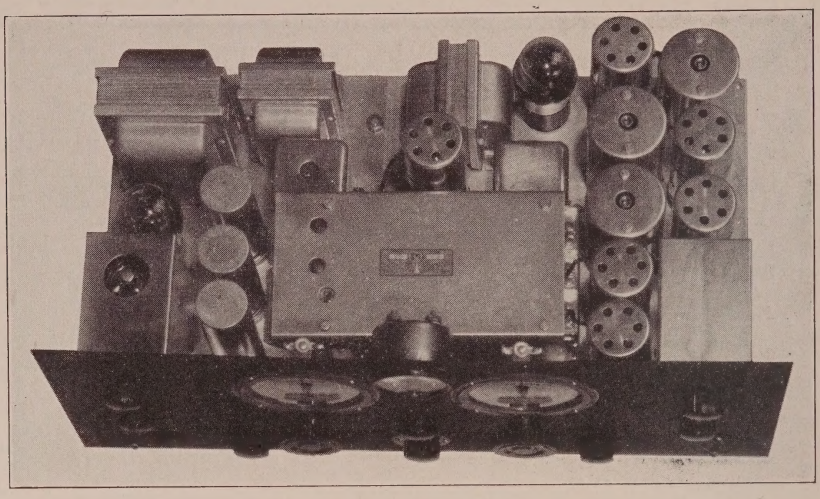

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No. 68 July, 1935

CONTENTS

With the Editor - - - - - - - - - - - - - - 6
Directive Antenna Arrays—*E. H. Conklin, W9FM* - - - - - - 7
Link Coupling—*Charles D. Perrine, Jr., W6CUH* - - - - - - 10
A Receiver with Very Low Noise Level—*Glenn H. Browning* - - - - 16
A Simple 50 Foot Mast—*E. H. Conklin, W9FM* - - - - - - - 19
Radio Flood Warning Indicator - - - - - - - - - - - 22
Hams Across the Sea - - - - - - - - - - - - - 25
Antennas—*W. W. Smith, W6BCX* - - - - - - - - - - 26
Best Times for Foreign Reception - - - - - - - - - - 29
A "Local" Phone - - - - - - - - - - - - - 30
Modulation Notes - - - - - - - - - - - - - 33
A Mobile Antenna - - - - - - - - - - - - - 34
Condenser Tester - - - - - - - - - - - - - 35
Calls Heard - - - - - - - - - - - - - - 36
The Electron Coupled Oscillator - - - - - - - - - - 38
High "Overall" 7 mc. Efficiency—*Wayne Cooper* - - - - - - - 40
A Universal Voltmeter—*A. W. Parkes, Jr.* - - - - - - - - 43
The Open Forum - - - - - - - - - - - - - 44
Two Letter Calls - - - - - - - - - - - - - 61
An Inexpensive Pre-amplifier - - - - - - - - - - - 64
The Marketplace - - - - - - - - - - - - - 65

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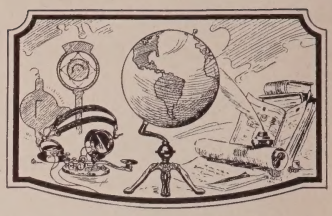
with the EDITOR



Helping the Other Fellow

The A.R.R.L. is making a survey of non-amateur occupancy of the frequencies between 6 and 8 mc. with the idea, we suppose, of showing the other fellows where they can go to if we should displace them from one side or the other of our 7 mc. band. Offhand we see no major objection to such a survey *provided* we see this matter in its proper perspective of unimportance. There is, however, a potential danger in such a procedure particularly in the hands of an unaggressive group. Suppose the results of the survey do not show, in the opinion of the surveyors, sufficient room for the stations to be displaced. Then they have placed a very handy weapon in the hands of their enemies, a stunt, by the way, which they have "pulled" before.

Let us worry about where displaced stations will be placed to just the same extent that they worried about us when we were displaced from two-thirds of our medium and long distance frequencies at the Washington Convention of 1927—and no more. If we *must* worry about the other fellow, let's at least keep it to ourselves.

And this might be as good a place as any to say that in our opinion, the officials of amateur radio have in the past done too much worrying about "the other fellow" and too little about the amateurs whom they are supposed to represent, to the great detriment of citizen radio.

Too Late

The board voted to make available to the membership the annual reports of the officers at cost *after* the Board meetings. This is a step in the right direction, but *only* a step. The proper time to make these reports available to the members is *before* the meeting, so that they may have all possible information on which to base their instructions to their Directors.

A.A.R.S. and U.S.N.R. Frequencies

Approval will probably be well nigh unanimous both inside and outside the U.S.N.R. and the A.A.R.S. on the Board's request that military and naval frequencies be assigned for drills rather than frequencies within the amateur bands.

The 1.75 mc. Band

The usual crop of rumors regarding the 1.75 mc. band are once again going the rounds. An official broadcast from the A.R.R.L. emphatically denies these rumors as groundless. We wish we were as sure. For the time being at least it appears pretty well protected by the provisions of the Madrid treaty and the North American Regional agreements. It is true, of course, that many countries' recognition of the treaty which they have signed is more conspicuous in the breach than in the observance, but fortunately these countries are too remotely located to create serious interference in this band.

But radio allocations are far from static. The allocation schedule, as most of our readers know, is "rehashed" every five years at an international dog-fight called the International Telecommunications Convention at which the United States with far more radio stations, we understand, than any other nation in the world has exactly the same vote as the little fellow with two of them—or none.

The next of these occurs at Cairo in 1937. At that convention it is inevitable that determined assaults will be made upon our bands, particularly upon the 1.75 mc. band which is desired by mobile interests in Europe and elsewhere, by the broadcasters, by a new group of "high-fidelity" broadcasters, by telephone interests for "short hop" links, by the police and similar units, and by others.

Amateur radio, either through its national organization or through direct individual action of the amateurs or both, must induce Congress or the President to instruct the U. S. Cairo delegation to adopt a most uncompromising attitude in the matter of frequency assignments if we are to come out unscathed. The "pressure" brought to bear upon this band at Madrid during a major

[*Continued on Page 48*]

DIRECTIVE ANTENNA ARRAYS

For High Frequency Work

By E. H. CONKLIN*

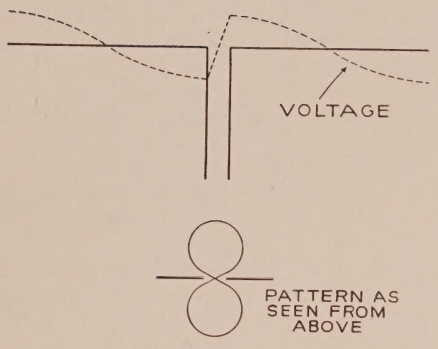


FIGURE 1
The "double zepp." and voltage distribution on the radiating portion.

I am getting to be a "bug" on the idea that nowadays the weak link in code transmitters (phones need carrier suppressing) is the antenna system. Here is a review of recent experiences.

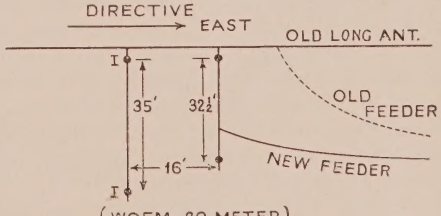
Last summer we put up a 260 foot wire, nearly east and west, which immediately improved my 7 mc. signals in Australia as compared with a half wave due east-west antenna. On 14 mc. we worked NY2AB, PY5AF, and HB9Y with signal reports about equal to those for a 65 foot wire operated as a full wave antenna. The long wire, of course, was operated at its 8th harmonic. On 28 mc., using the 16th harmonic, stations were raised "off the ends" last summer, but except for one W5 no luck was had raising W4 and VE4 "off the sides".

This March, we received an R7 report on 14 mc. from VK4GK, but only R3 and R4 from F8FC and F8EO. Then we found it quite difficult to raise anyone! Getting convinced that east-west gain was needed we tried a horizontal double zepp. (figure 1) broadside to Europe which should provide some gain. An hour or so on this and still we did not raise the dx, so as a last resort we hung a vertical doublet from the long wire as a support, put a reflector behind it (west). (See figure 2.) Or if the unused long wire worries you see figure 3 instead. That's been used too. Theoretically, and closely approached in practice, adding a reflector behind *any* antenna gives a 3 db. gain in the forward direction, equivalent to *doubled* power.

Fred Marco was not convinced, and promised to eat a glass insulator with whipped cream on it if we did raise the first station called. He called PA0XG who came back, said we were the loudest W9!! My turn next. A good report was received from EA4AV. The next morning F8FC, G2NH and others were raised. Raised D4BAR a few days later. At *right angles* to the antenna's best direction, an X1 gave us a *fair* report, VP5JB and others at 45° were raised, without much difficulty. But *none* could be raised to the west. Returning to the long antenna, results were again nil.

Well, what's the explanation? Perhaps:

(1) Chance.
(2) Long antenna badly out of tune—and it's a fact that at higher harmonics increasingly large antenna errors must be absorbed by the tuning system.
(3) Polarization.
(4) Angle of radiation.
(5) Gain.



(W9FM, 20 METER)
FIGURE 2

Most likely bets are (2), (4) and just a little (5).

Another example is W9BRX. During a week in March that station worked about 12 countries in Europe and Africa, none in South America, with a horizontal "double

*512 North Main St., Wheaton, Ill. (Holder of W9FM jointly with Fred Marco of W9ZA).

zepp." as described above. Finally the feeders were clipped together and as a *Marconi* antenna (yes, using a ground) it worked HC1FG south.

Still another: At W9DXP at my suggestion there was put up a vertical antenna

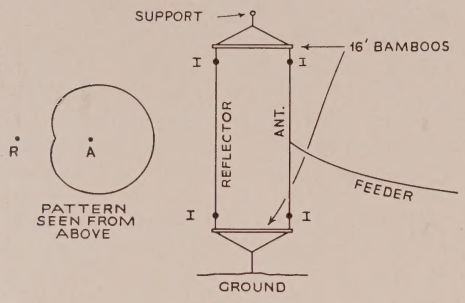


FIGURE 3

If some means of taking up slack in the feeder is provided and stays fastened to the bamboo spreaders, the above antenna-reflector can be aimed at any elusive country by 5 minutes work to give a 3 db. gain.

with reflector and 2 directors as in figure 4. These also hung from an old 132 ft. antenna, flower pots used as "sinkers". On receiving (usually a difficult test due to poor impedance match of single wire feeder to receiver), he found Mexican stations which were audible on any other antenna completely dropped out with the directional one and all reports from the east coast (the "proper" direction) were R9 with 200 watts input. No Europeans were called at the time.

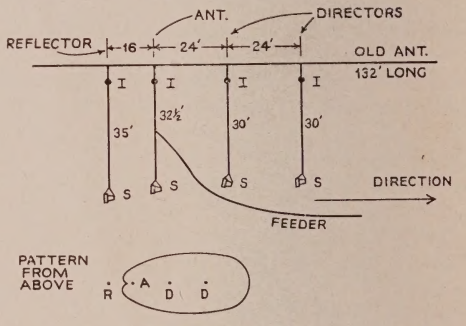
At 20 meters the simplest (ungrounded) array is one requiring a space of only 17 feet horizontally and 36 feet vertically. At 40 meters *grounded* arrays are feasible within a reasonable space. The simplest one calls for only 34 feet horizontally and 36 feet vertically, which certainly is not prohibitive. If the need of a good ground seems prohibitive one may always try a connection to the center of a half-wave horizontal wire. Parenthetically, that isn't a bad sort of ground for speech equipment.

Amateurs need "end fire" arrays, or broad arrays with reflectors to give broad "noses" to the radiation pattern (so as not to miss the desired region accidentally) and at the same time to kill backward radiation in favor of forward gain.

Feeders

Most of us never give a 1-wire feeder a fair chance. See the *Proceedings* of the Institute of Radio Engineers, October 1929, for the following facts:

1. The length of the antenna wire required for ½ wave depends upon the height above the "electrical ground plane" and varies in the manner of figure 6.
2. Feeder wire size effects the best location of the tapping point where the wire should strike the antenna.
3. *When properly adjusted* the feeder losses are *very small*, even at feeder lengths of ¼ *mile.*
4. The easiest way to tune:
   a. Insert two adjacent meters, feeder between them, in the antenna (figure 7A).
   b. Vary transmitter frequency or antenna length until the meters show the same *current,* showing no distortion of sine wave by feeder. See figure 7 and particularly note the positions of meter-needles. As usual a larger current is indicated by a movement of the needle toward the right.
   c. Remove the 2 meters, put one at center, vary feeder connection point for highest current. Under these conditions, 3 meters placed ¼ wave apart in the feeder would read alike.



(W9DXP, 20 METER)
FIGURE 4

Above is seen the temporary experimental W9DXP array. Of couse such an installation would give trouble in any kind of wind. For a permanent installation, the supporting wire should be broken up every few feet with "airplane-egg" strain insulators and the vertical wires should be anchored to the ground to keep them from flopping. The pattern for such an antenna is shown below.

An oscillator, non-crystal but *of good regulation* will have a pure resistance load when the *properly adjusted* feeder is conected to it, whereas even 10 kc. either way the oscillator will

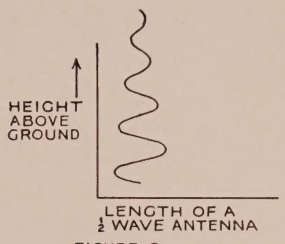
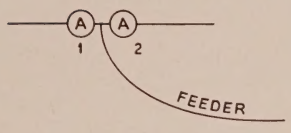


FIGURE 6



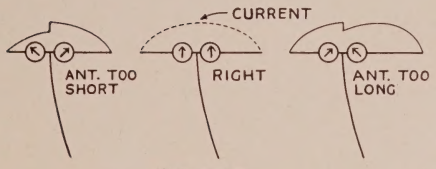


FIGURE 7

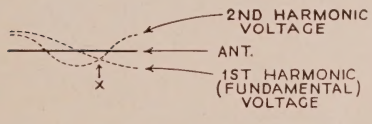


FIGURE 8

shift frequency one way or the other, when the feeder is connected to it.

If you don't want to cut the antenna wire, why not put the meters in the center of a 6 foot wire with the feeder between them, bridge the whole thing across 6 feet of the antenna, supporting with string at the center to avoid a "Y" shape? Of course this does not have the advantage of giving you the true antenna current in amperes, and it *is* nice to be able to figure antenna watts on the basis that a halfwave antenna represents about 70 ohms.

R.f. meters often differ amongst themselves by 10-20%; better check them against each other in advance by putting both in series with a 1-turn coil and coupling to the transmitter to calibrate.

Another thing—when making all of these tests better start with low power; under some conditions the circulating currents are very heavy. Incidentally it is *quite common* to find 1-wire feeder combinations so far off that they *cannot* be adjusted properly; hence the antenna length had better be checked at the start, especially for a harmonic antenna.

5. By simple trigonometry, the first and second harmonics require *different* feeder taps *unless* the feeder wire size is such that the tap *happens* to fall at point X in figure 8.

In our case a 65 foot antenna, with a no. 14 wire feeder 8'10" off center tunes to 7260 kcs. but for 14 mc. the feeder should be about 11'6" off center.

6. For other details and for feeder losses up to ½ mile (they aren't so bad at all) see the I.R.E. *Proceedings* already cited or the 50c antenna booklet obtainable from Ohio State University, and mentioned in the I.R.E. article above referred to.

Some ideas on the efficiency of the ordinary feeders are as follows:

1. A ¼ wave 2 wire feeder has small loss.

2. Longer (say ½ wave or more) *tuned* feeders have greater losses than *properly adjusted* single wires (checked in practice).

3. Longer *impedance matched* 2 wire systems have a slight advantage over the single wire system due to the elimination of the return through the ground—not particularly low resistance at 7 mc. and 14 mc.

"Matching Networks"

A *properly adjusted* feeder system can *not* be improved by the use of any so-called "matching network" at the station end of the line, as a perfect match can't be improved. If the network improves matters *this is positive proof that the feeder was never properly adjusted in the first place.* While the extra equipment is not necessary, and the thing could be done more simply, it is true that a 1-wire feeder improperly adjusted can be matched better *to the transmitter* by such a network. But no network *at the transmitter* can correct the errors at the *other* (antenna) end of the feeder.

Better omit the "network" and do the job properly in the first place, as already outlined.

[*Continued on Page 46*]

"LINK" INDUCTIVE COUPLING

Its Uses and Advantages

By CHARLES D. PERRINE, JR.*

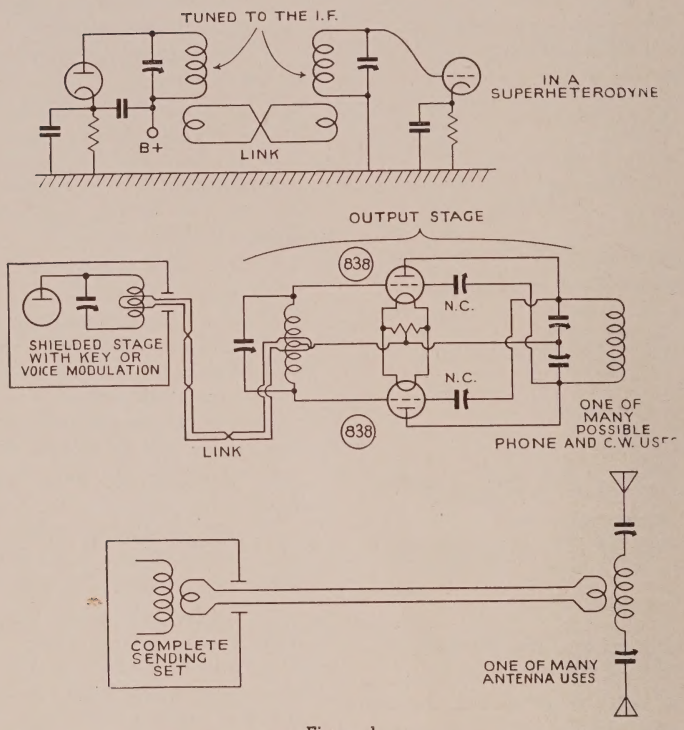


Figure 1

A "link" means an *untuned* low-impedance circuit, or 2-wire line, used between other circuits (usually tuned) to couple them together. The common form, and several of its uses, appear in figure 1. In the examples shown, and in many other cases also, the link circuit reduces the *capacity* coupling between the circuits, avoids the usual blocking condensers, permits easy adjustment for proper coupling and frequently simplifies the use of shielding since the link circuits carry no high voltages. Perhaps most important of all, changes in coupling have little detuning effect on either "tank" circuit.

It is rather difficult to mix generalities and details and still make everything clear. Let us therefore first attempt an understanding of the principles involved in link couplings as this not only helps one to build and adjust them correctly for one particular transmitter but also to apply them to best advantage in other transmitters. Such an understanding is very useful since it is impossible for any article to cover all the problems that are likely to arise in the multitude of transmitter types in use today.

The antenna and receiver[1] uses of link coupling will be passed over and only the transmitting uses considered, especially between stages of a multi-tube set.

Let us consider *any* amplifying tube in the

*527 23rd Street, Manhattan Beach, California. (Owner of W6CUH.)

[1]For the use of link coupling in a receiver see May 1935, *R/9*, pages 12-15 inclusive.

set, and the preceding tube which drives it. The "amplifier" may be feeding the antenna or still another amplifier stage. The tube ahead of the amplifier shall, for this discussion, be called "the driver".

First let us look at the "driver" tube, thinking of it as a generator. This generator feeds power into the load represented by its plate tank circuit, and the power drawn *from* the tube increases (up to a certain point governed by tube limitations) as the impedance of the load is reduced. Such apparent reduction of the tank impedance is normally accomplished by coupling to it a load, which may be an antenna or (as in this case) the grid of another tube[2]. As coupling is tightened, the tank impedance drops and the power drawn from the driver increases. In other words, the tank acts as an impedance transformer. It is the purpose of the tank (and the coupling arrangement) to transform the actual load impedance, (whether it be the grid of another tube or a transmission line) to the value correct for the tube. Since the correct tube load is nearly a constant, the coupling device, when

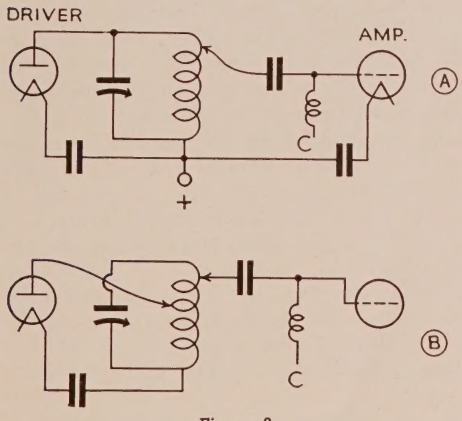


Figure 2

correctly used, is converting to that value whatever actual load is offered, whether a 30,000 ohm grid or a 600 ohm feeder. To accomplish such widely different transformations variable coupling is an absolute necessity for correct operation. This does not apply only to antennas and feeders. Amplifier tubes differ widely as to the impedance their grids present to the driving circuit. The effective grid impedance also increases with the bias. Consequently, a change in bias usually requires an accompanying change in coupling.

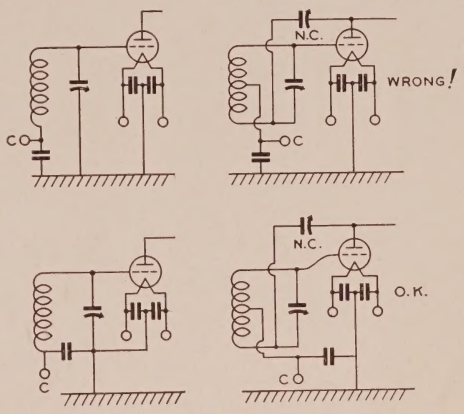


Figure 3

Variable coupling can be had with the common arrangement of figure 2A, sometimes called "capacity coupling", but the adjustment obtained is not flexible and may cause feedback and other undesired reaction[3], in particular wide changes of tuning with every coupling change. About the only way to step down the load impedance to match the driver's plate circuit as is usually required when exciting an 852, is to leave the grid of the 852 connected to the end of the driver plate tank and tap the plate of the driver tube down on the coil towards the node[4] or ground point, as in figure 2B. Correct coupling can be obtained with "capacity" coupling but it is awkward, and the coupling device is "hot".

Link coupling on the other hand not only affords easily variable coupling, but since the transmission line (link) is made of low impedance there is little radiation and voltage coupling (through capacity) to other parts of the transmitter; likewise insulation problems are lessened. Beginning at the

[2]In transmission the amplifier tubes normally work in Class B or Class C, which, among other things, means the grids are being driven hard enough to draw grid current. That is, they consume power and are actual loads, unlike a Class A grid. —TECHNICAL EDITOR.

[3]Not to speak of the commonest ailment, a leaky stopping condenser.

[4]In some tube combinations parasitic oscillations may result.

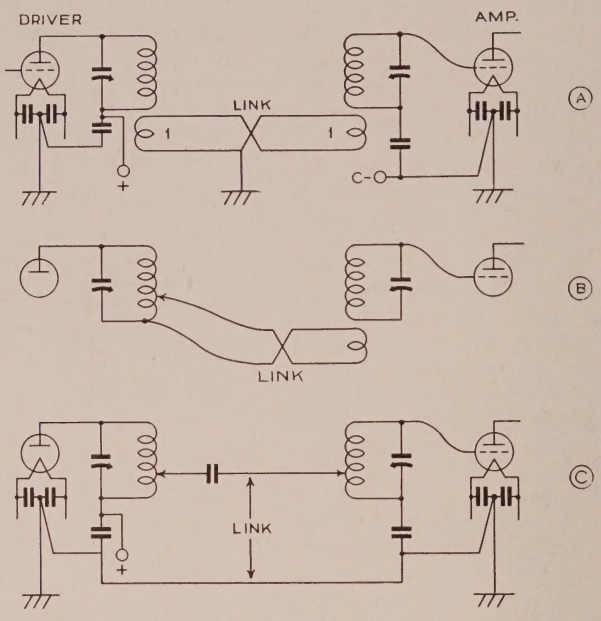


FIGURE 4

amplifier grid tank, the coupling adjustment of the grid coil and link coil is such that the grid impedance is stepped down to a low value, approaching that of the line. At the "driver" end the impedance is stepped up from this low value to whatever value is necessary to load the driver plate correctly for best output. Thus we have two points at which the impedance transformation can be varied, a variation which is easily made for the reason already noted, that changes in coupling have little or no detuning effect on either tank circuit, because the link coils are coupled to points on the two tanks which are as close to r.f. ground potential as possible.

Experience has shown that greater excitation is obtainable with link coupling, but an equally important advantage is the reduced feedback *in* the stages and *between* stages. Using link coupling the apparatus and bypass circuits of each stage can be kept close to that stage. Ground leads running between stages do not have to furnish return paths for r.f. as is the case with "capacity" coupling. Interaction *between* stages is decreased because greater separation of stages can be had. This is especially important in the final stage where the power level is high; the link can be made several feet long so as to place the final stage some distance from the rest of the set. In rack-and-panel transmitters efficient coupling between stages can be obtained, something that is *almost impossible* with "capacity coupling" at short wavelengths.

Of almost equal importance is the coupling from the crystal oscillator to the following tube, whether it be a doubler or straight amplifier. Correct loading of the oscillator is absolutely necessary if one desires good output without impairing frequency stability and increasing crystal heating.

Construction and Adjustment

We now come to the construction-and-adjustment side of link coupling, not that there is anything complicated about the whole business, but there are several ways of accomplishing link coupling and to make the picture complete we take them all in.

A grid tank circuit is necessary when using link coupling, the additional apparatus required being a coil and condenser. The coil should preferably be compact to restrict its field. Number 20 wire is large enough

for all low and medium power stages, while nothing larger than no. 14 is required for a 1 kw. job. The tuning condenser may have roughly one-fourth the voltage rating of the plate condenser of the same stage. It is well to place the whole grid tank assembly as close to the tube as possible to avoid long leads and chances of feedback. The lead from the "cold" end of the grid tank[5], through the grid bypass condenser, must go directly to the filament bypass condensers and not wander over half the rest of the set on the way. The "common ground" principle should also be kept in mind when wiring the complete stage; pick the center-tap of the filament bypass condensers as your common ground point and run all bypasses and leads to be grounded to it *directly and individually.* (See figure 3.)

Before considering the different link circuits let us look at the feedline. It can consist of parallel or twisted wires (twisted being better due to more complete capacity balance to ground and the rest of the set). And, as in all radio frequency transmission lines, the insulation must be good. It is often said that certain insulations heat with high power but are satisfactory for low power work. Nothing could be more misleading. Watts are far more precious when there are only a few to begin with. Twisted lines should have nothing less than good rubber insulation; that includes all the insulation on the wire—any cotton braid over the rubber is still in the r.f. field. Parallel wires slightly spaced are preferably left bare, but enamel will do no damage. The wire itself should always be solid because the losses in stranded wire go up quickly after reaching amateur frequencies. *Put that piece of twisted lamp cord back on the vacuum cleaner!*

The length of the feed line is unimportant if the losses are kept down. In practice no difference has been noted when a 2 foot line was changed to 20 feet. Since the line is non-resonant, both the r.f. voltage and current along the line are constant and of relatively low value; this means that the line can be run through baseboards and around corners without trouble. It is always best, however, to keep the line slightly separated from other objects along the greater part of its length.

[5]If the stage is Rice-neutralized the cold point is near the middle of this coil, and the bypass starts there.

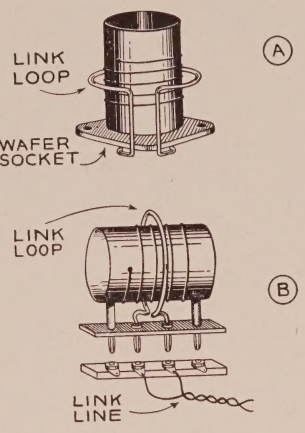


FIGURE 5

The most common type of link coupling is that shown in figure 4A. It uses a single turn loop coupled to the "tanks" at each end. While there is actually very little difference between the three methods shown as A, B and C, the double-loop system is likely better because it reduces capacity coupling between the two stages. (The coupling *should* be 100% inductive.) The coupling loops can be mounted in several ways. Figure 5A shows a method applicable to low power tanks, either grid or plate. An ordinary coil form is used plugged into a socket. The link loop (of about no. 14 to 16 solid wire) is soldered to 2 spare contacts on the socket, these same plugs serving as terminals for the feed line as shown. The loop is then self-supporting. Adjustment can be secured by bending the loop support wires so as to move the loop up and down the coil. Two small stand-off insulators mounted next to the coil form can also be used to mount the link in similar manner. Figure 5B shows a more elaborate arrangement for higher power stages. The loop is mounted on two plugs set in the base that carries the coil form. Again the coupling can be varied by bending the loop back and forth, and since loops are changed with the coils, correct coupling to each coil is had automatically once preliminary adjustments have been made.

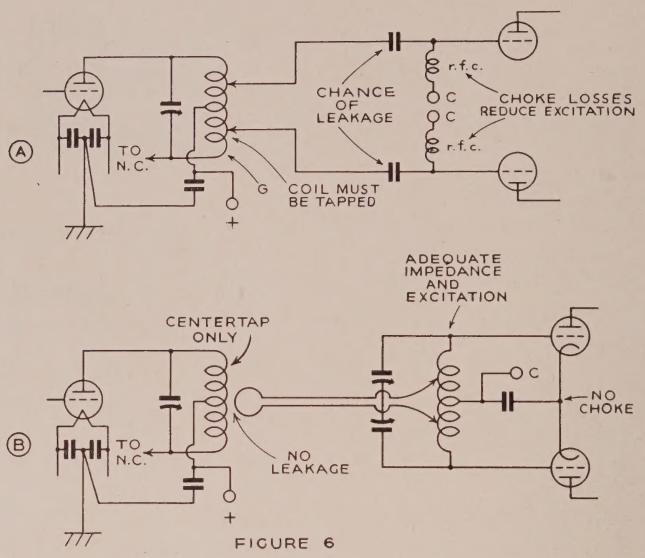


FIGURE 6

In figure 4B a loop on one end of the link-line is coupled magnetically to the grid tank but the other end of the line is tapped directly on the plate tank of the driver. Results are practically equal to those obtained with the double loop system. This method can be used where it is inconvenient or impossible to couple a loop; this is often the case when the tank uses copper tubing, it being easier simply to clip onto the tubing. The thing can be reversed equally well, the loop being coupled to the driver and the other end of the line clipped on the grid tank. In figure 4C the feed line is clipped onto both tanks, a stopping condenser C (about .002 μfd. rated to withstand the driver plate voltage plus the amplifier bias) is placed in one side to prevent shorting the driver plate supply. The other side of the line is simply tied to the "common grounds" of the two stages. Results are no better at best than with either of the other two types.[6]

Adjustment

To tune up, place the driver in operation with reduced plate voltage and tune its plate tank for a dip in plate current. The amplifier tube should have its filament lighted (but no plate voltage). The loop coupled to the driver tank is placed at the "cold" end of the tank (the center of the coil if one half is used for neutralizing either with the centertap bypassed to ground or with a split-stator condenser whose rotor is grounded). Once placed there, this loop is left permanently in place, as all coupling adjustments are done with the loop at the grid end of the feedline. In the tap-on system, clip the feeder on the tank about one or two turns from the point where the coil is bypassed to the filament.

The next step is to place the other loop near the cold end of the grid tank and tune this tank until resonance is indicated by an indication of grid current on the meter connected in series with the leads marked "bias". The coupling of the loop should then be changed, returning the grid condenser each time, until maximum excitation is obtained as indicated by the highest grid current reading obtained. The plate tank condenser on the driver should be retouched because there is usually a small reaction between the two tanks. The above can be accomplished almost as quickly as it can be read; and after neutralizing the amplifier in the conventional manner, you are ready for some DX[7].

[6]Except for the improved harmonic suppression and higher excitation offered by the tuned grid tank this circuit seems to offer nothing better than the "capacity" methods do.—TECHNICAL EDITOR.

[7]These are c.w. instructions. For a modulatee (stage-to-be-modulated) the object is, of course, to get only as much input as can be modulated.

Similar directions apply when using the tap-on method; moving the tap towards the grid increases the coupling just as moving the loop towards the grid accomplishes the same.

Anyone who has used meters carefully on a transmitter knows how difficult it is to provide balanced excitation from a single driver tube to a push-pull output amplifier (figure 6). Link coupling provides a thoroughly satisfactory method.

◆

LICENSE EXAMINATIONS

The Federal Communications Commission has announced that examinations for radio amateur operators' licenses for the remainder of this year will be held in accordance with the lists given below. Note that examinations will, in most cases, be held weekly or oftener at the offices of the various district headquarters, but only occasionally at other points. If you don't know the address of the nearest headquarters office it may be found in a copy of the *Radio Amateur Call Book* or from any amateur, or send a reply-paid postcard to *R/9*. Examinations begin at 9:00 a.m., local time; they are not held on national holidays.

Amateur Examinations at District Offices

Boston	Daily except Thursday
New York	Tuesday, Thursday, Saturday
Philadelphia	Wednesday
Baltimore	Wednesday and Saturday
Washington	Thursday
Norfolk	Friday
Atlanta	Tuesday, Friday
Miami	Daily by appointment
New Orleans	Tuesday
Galveston	Daily by appointment
Dallas	Tuesday, Friday
Los Angeles	Monday, Saturday
San Francisco	Monday
Portland	Friday
Seattle	Friday
Denver	1st and 3rd Saturday of each month
St. Paul	1st Saturday each month
Kansas City	1st and 3rd Saturdays of each month
Chicago	Saturdays
Detroit	Saturdays
Buffalo	Last Friday of each month and by appointment
Honolulu	Monday, Saturday

Examinations at Other Cities

Examinations will be held at various other cities in accordance with the table below. Contact the headquarters office of the district in which the city is located for further information. If you don't know the proper office to which to write, an inquiry will bring the desired information from *R/9*.

Billings	October
Bismark	August
Boise	October
Butte	November
Cincinnati	August, November
Cleveland	July, October
Columbus	September, December
Des Moines	July 27, October 26
Jacksonville	November 15
Little Rock	October
Oklahoma City	August, November
Nashville	August 16, November 15
Phoenix	October
Pittsburgh	September 19, 20, 21 December 19, 20, 21
St. Louis	August 23, November 23
San Antonio	September, December
Salt Lake City	September
Spokane	November
Troy	September, December
Winston-Salem	August 2, 3 November 1, 2

◆

ERRATA

The 838 is not a multiple grid tube as was stated in the caption on page 7 of June *R/9*. A very fine mesh single grid gives it its very high μ, the μ varying with input signal to give high output with low distortion. The National type NCB, a zero bias "100 watt" tube first brought out in 1933 and having characteristics somewhat similar to the new 838, obtains its high μ by multiple grid structure, two staggered grids being tied together inside the tube.

One page 40 of our June issue the 4th line from the bottom of the second column should say "regulation" instead of "regeneration".

The caption to figure 4 on page 13 of the June issue should read "at a distance of 225 feet." and not "25 feet".

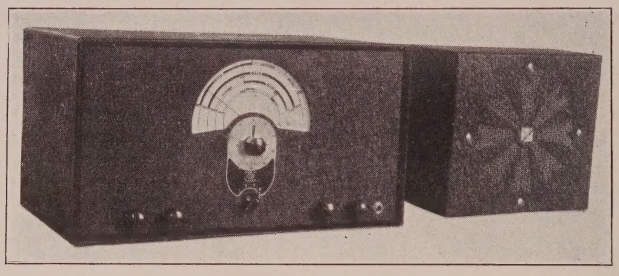
◆

If you crack too many of those little dinkey standoff insulators when screwing them down, stick them down with Duco Household Cement instead. They will break before you can pull them off when once stuck. For looks you may stick some screw heads into the two mounting holes with the same brand of "stickum". It is a good idea to experiment first to ascertain whether or not the cement will take hold on the surface on which you wish to mount the standoffs. —VE5BC.

A COMMUNICATIONS TYPE RECEIVER

With Very Low Noise Level

By GLENN H. BROWNING*



The Glenn Browning Amateur Type Superheterodyne

An amateur-band receiver in kit form must, if it is to be popular, provide a better receiver for considerably less money to repay the amateur for doing his own assembling and construction. In designing such a receiver for the 20, 40, 80, and 160 meter bands it has been the writer's aim to provide a very high-class set at a reasonable price.

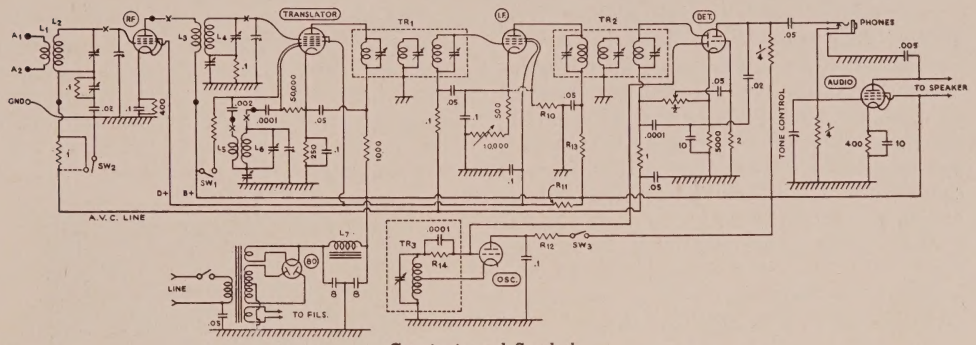
It may not generally be known that in the design of such a receiver the signal-to-noise ratio may be greatly improved by carefully designing a sharply tuned input system as well as the radio-frequency transformer in the preselector stage. This has been carefully considered in the receiver to be described, and we believe that an exceptionally good signal-to-noise ratio has been obtained. In fact, practically all of those who have operated the receiver have commented particularly on this feature.

As will be noted by the circuit diagram the receiver is a superheterodyne consisting of a sharply tuned input system, an r.f. amplifier (sometimes called a preselector stage), one stage of band pass triple-tuned i.f. amplification, and a diode-triode detector followed by a pentode audio power tube. Automatic volume control has been incorporated as well as a beat-frequency-oscillator for c.w. reception. A switching arrangement switches off the a.v.c. when the beat-frequency oscillator is turned on. Two volume controls are used, one controlling the signal to the grid of the triode section of the 2A6 (or 75), while the other controls the gain of the i.f. stage. It has been found that a considerably better signal-to-noise ratio may be obtained by reducing the gain in the i.f. amplifier where maximum amplification is not needed.

The r.f. tuner, which is the heart of the receiver, is a single control tuning "catacomb" and consists of the 12 inductance coils for the four bands covered, the trimming and padding condensers, and the 85 μμfd. variable (tuning) condensers. The band-changing switch shorts out all coils which are not being used in the circuit. Shields segregate the antenna coils from the r.f. transformers and the oscillaor coils so that there is no interaction between these circuits. The tuner is carefully aligned and tracked at the factory but as the bands covered are extremely narrow it may be necessary for the amateur to make slight adjustments on the trimming condensers in order to have the ranges covered exactly the same as those marked on the model dial card. In combining the r.f. tuner unit with an i.f. and audio system to form a complete receiver there are only 7 connections and a ground which the set-builder must complete to the tuner.

On the 80 and 160 meter bands, bandspread is obtained by using small-range tuning condensers. On the 20 and 40 meter bands, however, condensers must be employed in series with the tuning condensers in order to spread these bands over approximately the same dial area as that of the two lower frequency bands. This is automatically taken care of in the tuner switch.

*Consulting and Research Engineer, Appalachian Road, Winchester, Mass.



Constants and Symbols

X—Contact of tuning-range switch (unused coils shorted).
●—Indicates soldered connection to ready-made coil-condenser (tuning) unit.
A_1—To antenna or ½ of doublet.
A_2—To other half of doublet or jumper to G.
G—to earth.
L_1, L_2, L_3, L_4, L_5, L_6—Coils of tuner unit, one set shown.
L_7—1800 ohm loudspeaker field.
R.F.—Type 58 or 6D6.
Translator—Type 2A7 or 6A7.
I.F.—Type 58 or 6D6.
DET.—Type 2A6 or 75.
AUDIO—Type 2A5 or 42.
OSC.—(Tone oscillator for c.w. or station-hunting) type 56 or 76.
TR_1—TR_2—3-coil 465 k.c. i.f. transformer.
TR_3—Tone ("beat") oscillator transformer.
Resistors not marked on diagram for lack of space are as follows:
Translator gridleak, 50,000 ohms.
Resistor in series with SW_2 (feeds B+ to "plate-equivalent" of oscillator section of translator, also called no. 2 grid), 20,000 ohms.
R_{10}, 20,000 ohms.
R_{11}, 25,000 (Screen-dropping).
R_{12}, Osc. plate feed, 50,000 ohms.
R_{13}, de-coupler, 1000 ohms.
R_{14}, osc. gridleak, 50,000 ohms.
Condensers drawn with one straight line and one curved arrow are sections of tuning condensers. Trimmers shown by two lines crossed by an arrow.
Switches—See text.

The action of the switches is much as usual, except that the tuning-range switch shorts all unused coils to prevent "sags" in the sensitivity curves, due to resonances of unused coils.

Only one set of coils could be shown conveniently in the accompanying diagram. The 0.1 megohm resistors and series trimming condensers in the t.r.f. circuits (ahead of the r.f. and translator tubes) are in use only for the 20 and 40 meter bands. The switch cuts them out at 80 and 160 meters.

SW1 cuts off the oscillator-section of translator, stopping the set while transmitting.

SW2, if wired per solid line, cuts off a.v.c. action from the r.f. tube when closed. If wired per dotted line, a.v.c. action is also cut off from the i.f. tube.

SW3, on same shaft with SW2, starts the i.f. oscillator to permit c.w. reception or "station finding".* The tuner is mounted on soft rubber insulators and grounded at one point only which completely eliminates chassis currents in the tuner itself. The soft rubber insulators also reduce mechanical-acoustical vibrations of the tuning-condenser plates which would cause electro-mechanical feed-backs.

As said before, the tuner is absolutely single control. The amateur bands are spread out over about two-thirds of the dial, leaving the other one-sixth on either side for foreign amateurs. The dial has a scale length of about 5 inches. Ample band-spreading is obtained, as shown by the following table:

Band in meters	160	20	40	20
Kc. per turn of tuning knob	26.5	20	18	17
Kc. per smallest dial division	2	3.4	2.0	3.0

*The construction permits several other methods of feeding the beatnote or intermediate-frequency oscillator "OSC" to the system. The lead to the diode plate of the detector may be taken from the left (coil) end of R_{14}. With either this connection or the one shown in the diagram it is permissible to remove R_{10} and connect the suppressor grid of the I.F. tube to cathode as shown by the dashed line. These connections are to be preferred for c.w. reception where a strong beatnote is desired. Try both sides of R_{14} to see which intensity you prefer. If only a weak beatnote is wanted, as for station finding or checking on frequency-drifts without interference to speech intelligibility, R_{10} should be used, the dotted connection omitted, the two diode plates of the detector tied together and the lead from the "OSC" grid to the diode plate omitted. Instead a lead is taken from the "OSC" grid to the suppressor of the I.F. tube, that is to the left end of R_{10}. The selectivity of TR_2 is sufficient so that a materially weaker beatnote is obtained.—TECHNICAL EDITOR.

A band-pass 465 kc. intermediate frequency stage with triple-tuned i.f. transformers has several advantages, for not only does it give rise to a broad-nose tuning curve which gives better quality of received signals and overall better selectivity but as the intermediate *tuned* link circuit is not connected to a tube, but merely grounded, it retains the factory setting; hence it acts as a "key" in the final alignment of the i.f. stage. The link circuits should *not* be adjusted by the amateur unless an *accurately* calibrated signal generator is available.

Exposing a Fallacy

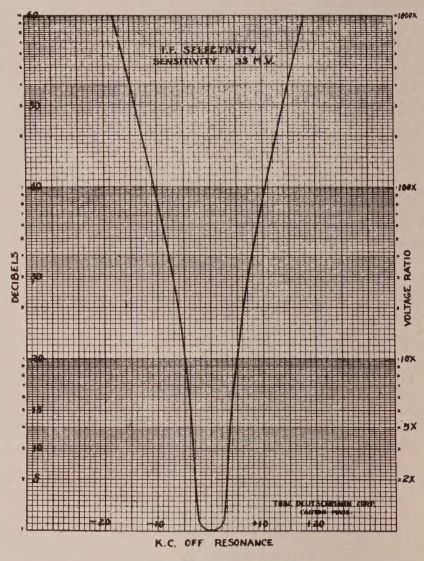
In the writer's opinion, sensitivity data as taken in accordance with standard practice have very little signficance. The writer has seen receivers which, when the volume controls are fully advanced, will give almost 50 milliwatts output of *noise* in a shielded room *without any intentional input.* The measured input signal for 50 milliwatts of output may be practically nothing. Other receivers with *less* noise consequently show up, as far as "standard sensitivity" is concerned, as considerably *poorer!* It is believed that at some time the present standard method of taking sensitivity data will be changed and that standard procedure will be to put in sufficient signal so that 50 milliwatts of output* is obtained *exclusive of set noise.* In this connection it is rather interesting to compare one and two i.f. stages. As a general rule two i.f. stages will give more noise than a single stage; consequently if by careful design sufficient amplification can be obtained with one stage, the signal-to-noise ratio of the complete receiver is bound to be improved.

With the above thought in view the sensitivity of this amateur communication receiver was measured according to standard procedure and also by taking a 50 milliwatt *signal* output *exclusive of noise.* The results of these tests are shown in the accompanying table.

Frequency in megacycles	Microvolts for 50 milliwatt output including noise.	Microvolts for 50 milliwatt output exclusive of noise.
14.2	0.5	0.8
7.1	0.3	0.9
3.9	0.5	1.5
1.8	0.6	1.9

*Meaning real audio, aside from noise.

The above data were taken with a very high-grade signal generator but it is believed that the attenuation net-work is probably somewhat inaccurate at the higher frequencies. However, the comparative results are interesting. It will be noted at high frequencies that for this receiver there is



apparently less noise so that the signal increase for the 50-milliwatt output *exclusive* of noise is only slightly greater than that *including* noise, while for the other three bands a signal input of approximately three times is necessary to give the 50-milliwatt standard output above the noise level.

If a standard 500-milliwatt output were used instead of a 50-milliwatt, the noise level, in some cases, would be practically negligible. In the receiver just described the *true* sensitivity over all the bands for a 500-milliwatt output is between 4 and 5 microvolts.

◆

G6SY after experimenting with uni-directional receiving antennas made the surprising discovery that W6 signals come from the *east* . . . . the "long way around".

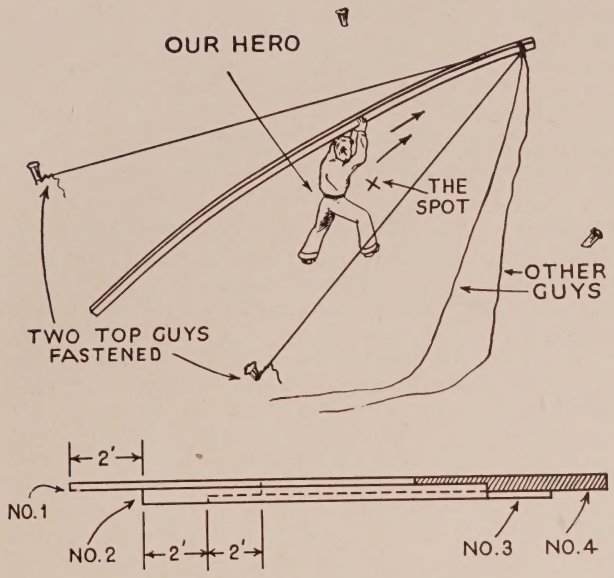
◆

One ham who is a doctor in his spare time writes in and says that by tuning an antenna to his diathermy machine (6 meter "ultra short wave therapy") he can work stations up to 20 miles with little trouble.

A SIMPLE 50 FOOT MAST

Easily Raised by One Man

By E. H. CONKLIN*



Here we have our hero pulling a strong arm act by hoisting this 50 footer "single handed". We know it works because we tried it on the office floor with a yardstick and 10 feet of string.

Below is shown the method of "staggering" the pieces so that no two joints come in the same place. The pieces could just as well be staggered 4 feet, making the joints an even distance apart the entire length of the 48 foot pole.

A 40 foot 2 × 2 pole put up single-handed, or a higher mast erected with the aid of all the "hams" in the neighborhood, would not be news. But when a 50 foot mast is erected on an apartment building roof by one man with no difficulty—well, that's a story.

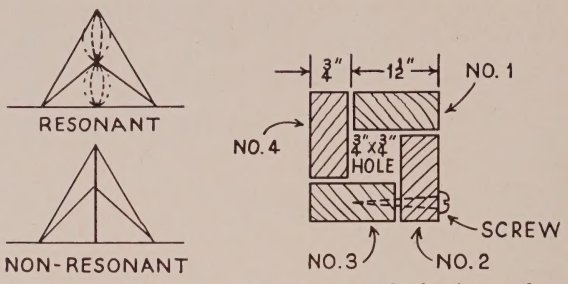
When W9NRU needed a new tower, Fred Fuller considered the advantages of light weight 2 × 2's and the greater strength of larger lumber or lattice-work. The result was the hollow arrangement shown in figure 1, combining light weight features with strength. The material is 2 × 1 furring strip available at the lumber yard in no. 1 white pine (clear) at 2½c a running foot, and 1½c for no. 2. A 50 foot mast would, of course, require a total of 200 feet. While no. 1 clear lumber was used, a check with a local lumber yard revealed that if you wish personally to pick out the pieces with only small knots, the no. 2 would do nicely. That means $3.00 for enough wood for a 50 foot mast. Not bad.

*Wheaton, Illinois, owner W9FM.

Lay two lengths of the strip side by side, but so that the end of one piece extends 2 feet beyond the other. Using 2 inch brass wood screws spaced 2 feet apart, fasten one piece to the other, forming an "L" cross section. Similarly, fasten the third piece, also staggered 2 feet, and then the fourth, making a box-like cross-section, as shown in the figure. Because the grain in one piece of the wood is at right angles to that in adjacent pieces, the strength is much better than in a single 2 × 2 without a proportionate increase in weight. In fact, if you are comparing the usual fir 2 × 2, the box affair will be lighter.

Proceed by laying the fifth section at the end of the first, screwing it to the other pieces, etc. When the required length has been obtained, saw one end off even (6 feet) and use this section to complete the box at the other end.

The top should be closed up, either by screwing a 2¼ inch square piece flat on the end, or better yet, fill up the last foot or two of the central "hole" with a ¾ inch



To the left is shown what happens to a pole that is guyed at the top and exactly in the center. Guying "off node" as in the bottom illustration will prevent such mechanical oscillation. To the right is a cross-sectional view of the pole.

square "plug". Similar plugs would improve the strength at the bottom and at the point where the center guys are to be fastened.

Before raising, apply two or three coats of good white-lead-and-oil paint; it lasts longer.

Two sets of guy wires are necessary, one at the top and the other near the middle. If the bottom of the mast is fastened securely for a foot or more, the lower set of guys can be at the center. If the bottom is resting but not fastened, put the lower guys somewhat above the center to prevent flexure or "full-wave oscillation".

Do not fasten the guys to screw eyes, which are sure to pull out some windy day. Instead, pass the guys clear around the mast, thus holding all four of the strips together rather than pulling them apart. A neat way is to put in four screw eyes and pass the guy wires through *all* of the eyes. The same thing holds for the pulley.

If your antenna ever breaks, you will be glad if you have provided a "down-haul" as well as an "up-haul". Use a continuous circle of halyard, fastening the antenna at the splice in the rope. A second pulley and halyard will often be handy.

To erect, calculate the length of the two top guys which are to be fastened farthest from the top of the mast "as she lay". Use your trigonometry, or lay out to scale on paper and measure the guy length. Fasten those two adjacent wires. Stand at the center of the mast, lift it and push *toward the top,* holding the bottom end down and raising the top end. The two fastened guys will keep the mast from coming down if you need to stop and rest. When you get it above 45°, fasten the other top guy or guys, and carry the bottom of the mast over to where it is to go. Straighten her up with the guys and call it a day.

Fuller's mast used three 16 foot lengths (12 in all) of the strip, total height 48 feet. He says that he would not hesitate to raise a 60 foot mast of that construction *alone.*

[Appendix]

Hints: The rope should be paid along the mast while raising; if left dangling from the top it not only feels a whale of a lot heavier but is free to mix with everything. For such a light mast 3 guys at the top and 3 at the slightly-above-middle point are enough if about no. 14 galvanized be used, but *don't* nick it or make kinks and then figure they are all right after being straightened—they are *not.* Four guys at each of the 2 guying points makes plumbing the mast a good bit quicker but weighs the mast down more. Incidentally, don't try to make a light mast rigid; it is much safer and longer lived if permitted to sway a little. Especially, it will not "bow" so soon. One way of fastening the guys is to pass them once right through the mast, then around once, and make a long twist—say a foot. In laying out the original length of the guys allow 10 feet extra for dancing around the obstructions that always pop out of the ground when a mast is started upward. Even the measured-off guys ought to have this slack-for-luck, though secured at the correct point. When working alone, the crucial point comes when the mast is about 60 degrees off the horizontal and starts to look tall. Have a pre-arranged way of fastening the butt there and secure an "opposing" guy so that if the thing overbalances by act of you or the wind there will be something

left besides splinters. If even one helper is available it is sometimes a good deal easier to neglect the top guys and use the slightly-above-center ones during erection; the leverages are more favorable. When done, please don't be a fool and climb the thing to fix something that was overlooked. Get help and let it down. A hospital is a mighty tiresome place.

◆

RADIODDITIES

By RUFUS P. TURNER, W1AY

The zeppelin antenna was so called because it was designed for use on the zeppelin type of airship . . . They called them *tank* circuits because of their ability to store energy . . . The term TNT was applied to that popular transmitter circuit not because it is as powerful as the explosive bearing the same initials, but because the grid was thought to be entirely untuned; the plate tuned, hence *tuned-non-tuned* (TNT) . . . The *Tri-Tet* from the terms triode and tetrode, descriptive of the tube arrangements used in the circuit.

◆

One angel radio manufacturer set aside an entire floor of his large plant for the use of hams with ideas . . . Anne Lindbergh is a proficient radio op. She has her radio-telegraph class ticket and pounds Morse on trips with her famous husband . . . Robert Boyle (chemistry students take notice) first used the word *electricity* in 1675 . . . Jack Radios is a hat cleaner in Chicago . . . Harold D. Whitney, W2ANV, of Glen Falls, N.Y., kept regular early morning schedules with a Montreal ham in 1929 for the purpose of reporting weather conditions along the Albany-Montreal air mail route . . . Diall, Trimmer, Short, Power, Watt, and C. W. Morse are all listed in the Boston telephone directory.

◆

Archibald Montgomery has patented a system for using the exhaust smoke of an automobile as an antenna! . . . Dr. H. D. Pratt, a noted scientist of Chicago, proposed wireless communication between New York and Chi by means of X-rays sent through one of the upper strata of the air. In effect, his system would make a huge electron tube of the space between the two cities . . . The tenth U. S. district is all over the landscape —W10 calls are assigned in all nine districts and to expeditions . . . Recently, sound engineers found Chicago the noisiest city in the Country. 85 decibels were obtained there, as opposed to 75 in New York! . . . Broadcast stations maintain their frequencies within fifty cycles, plus or minus.

◆

Maxwell and Henry are in Nebraska; Contact and Sparks in Nevada; Weston and Triplett in Missouri; and Atwater and Kent in Minnesota . . . *Bias* is in West Virginia while *Voltage* is away over in Oregon . . . *Call* is in North Carolina and *Signal* in Arizona. Truly, the twain shall never meet!

◆

Police-ham co-operation is of long standing. In 1921, the New York police radio station, KUVS, broadcast reports on stolen cars, and hams in various cities relayed the dope to their local authorities . . . In the Spring of 1922, police chiefs throughout this country and Canada received via the ham route invitations to attend a police chief convention in San Francisco . . . The first news of the finding of Australia's lost flier, Anderson, came to the U. S. over ham air lanes, beating the Associated Press by twelve hours! . . . It was a ham that was the first radio contact with the submarine *Nautilus* when she was tossing about in the North Atlantic, damaged on her Arctic adventure in 1931 . . . There was only *one* workable telegraph line out of Chicago during the dread sleet and snow storm in February 1924, and this lone press line to Minneapolis was crowded to capacity. Business and private citizens turned to radio amateurs. Myron J. Earl, 9CCM, directed a nurse on a case in Streator, Ill. for a doctor isolated at Long Point, both some distance from him.

◆

W2CK's initials are RF; W2COO's, SW; and along come W6CGU with VT and W6FVV with DB . . . V-8 is not a new car, but the international prefix for Mauritius; nor are Pa., NY, and La. states in the Union—these are the prefixes for the Netherlands, the Canal Zone, and Norway . . . W3AZC's middle initials are AC . . . and in perfect match, W7CXO's name is *Hum.*

RADIO FLOOD WARNING INDICATOR

Incorporates New Keying Device*

The State of California is now operating a series of automatic radio stream gage transmitters in connection with flood control and watermaster service activities of the Division of Water Resources.

The use of these radio stream gage indicators serves the public interest in a very vital respect. During major flood conditions advance information on the rapid fluctuations of streams on which they are installed makes them of paramount importance in the saving of life and property. In the watermaster† activities the saving of water and crops and the protection of individual water rights is of major importance. It is believed that no higher character of use of radio on land can be made than to protect citizens from potential flood hazards and to assure an equitable distribution of water.

A total of thirteen "radio stations" along the streams of California have so far been installed. The apparatus is semi-portable in character, and is readily installed in the standard stream gaging station instrument shelter houses at the points most desired during the course of the season.

Signals Stream Height

The radio transmitters, entirely automatic in operation, at frequent intervals send out a signal indicating the gage height of the stream at the moment. The signal is received in the State Engineer's office in Sacramento.

The fluctuations of stream flow in the major rivers contributing to the potential flood hazards in the valleys can be observed directly and accurately many hours in advance of the time when the crests of the high water would reach critical points on the valley floor. By means of this advance information a better, safer, and more satisfactory operation of the various flood control and relief structures along the river can be accomplished.

Without this new medium of radio communication, it is necessary to set up an elaborate system of telephone, automobile, and other facilities to obtain the important data of the stream flow in advance of the time of arrival of the flood crests at critical points. Such manual dependence often breaks down during the course of major rainstorms and flood flows when the information is most needed.

Aids Irrigation Work

The problem of efficiently distributing irrigation waters in the adjudicated stream systems in the State is greatly aided with the use of the radio stream indicators. Usually the transmitters are installed on the stream above diversions, at a point which is relatively remote or inaccessible. The watermaster, by listening in at frequent intervals during the day, can be informed of the fluctuations in the water supply to the irrigated area, and his time is therefore spent along the lower reaches of the stream where he is most needed to give many water users their due and proportional share of that supply.

Without the radio indicator it would be necessary for the watermaster to make a daily trip to the head of each stream in his jurisdiction to determine first his supply before he could make an accurate distribution of flows into the various dependent diversions. Aside from the saving of time and traveling costs, many instances can be pointed out where the timely indication of a sudden fluctuation of supply at the head of irrigation resulted in very material savings in water and of crops.

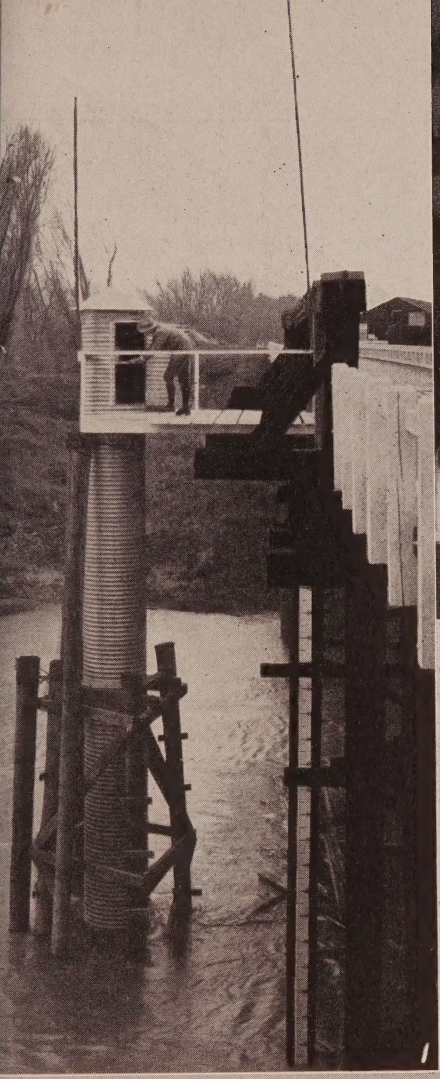
These automatic radio stream gage indicators are made possible by the use of a unique automatic keying device which was originally developed privately in 1931 by Associate Hydraulic Engineer Irvin M. Ingerson. Letters patent cover the apparatus.

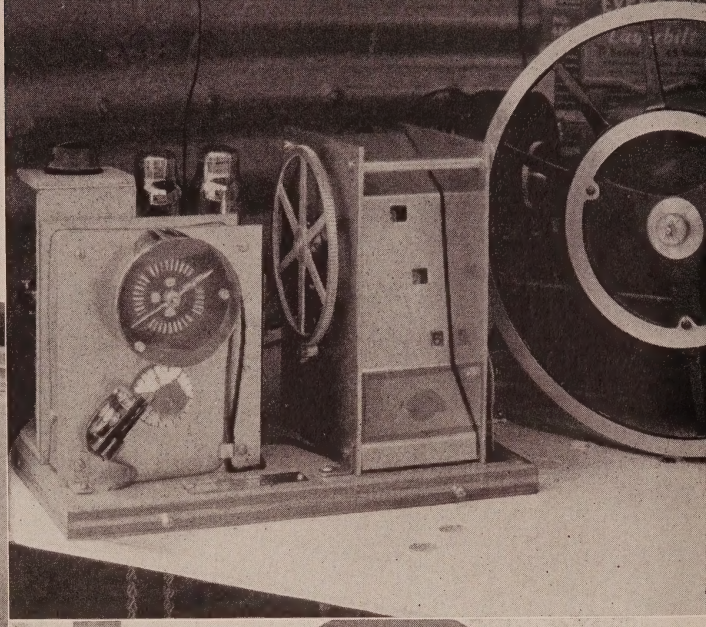
Operated by Keying Device

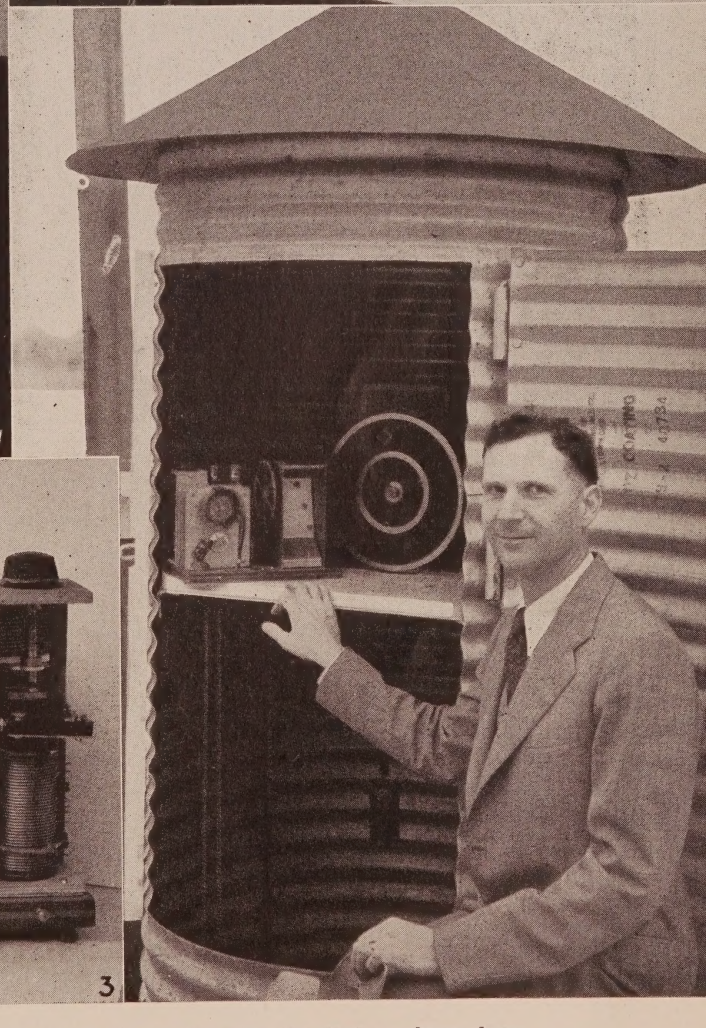
The automatic keying device consists of a series of commutators that are so arranged

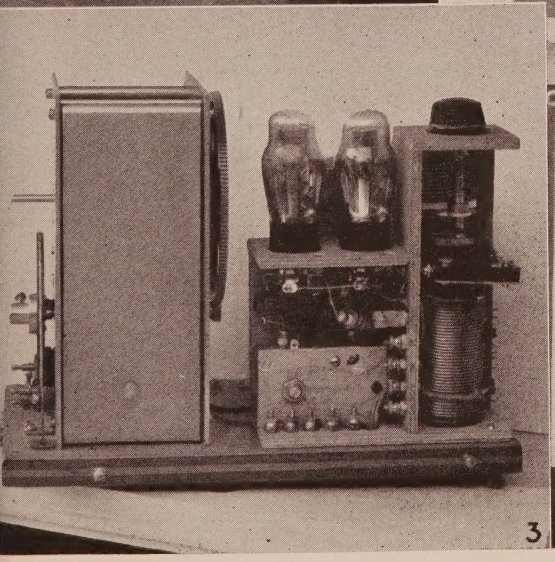
*Courtesy, *California Highways and Public Works,* Sacramento.

†California agriculture, unlike that of many eastern states, is almost entirely dependent on irrigation, wherefore an extensive, complicated, and continuously regulated distribution system is necessary to meet varying demands. The watermaster is the official in charge of this regulation for a particular watershed or district.—EDITOR.









Front and rear views of the gage keying device and transmitter described are shown above; the inventor, Irvin M. Ingerson, is shown lower right.

as to "key" the radio transmitter to give a signal that is the accurate gage height of the stage of the water at the time of transmission. For instance, a gage height of 7.42 feet would be listened to as being seven short dashes, at one-second intervals (easy to count), then a pause, then four dashes, then a pause, and then two dashes. The call letters of the station are also automatically "keyed." The keying device is operated by a weight-driven clock and by a float on the water surface in the gage well. This apparatus also is equipped with time switches which "turn on and off" the radio transmitter at any desired predetermined intervals.

The radio transmitter is a simple quartz crystal controlled oscillator using dry batteries entirely for both the filament and plate circuits. The signal is, of course, pure d.c. c.w. which can be received by any oscillating receiver covering the particular transmission frequency. Signals have been received satisfactorily at distances as great as 300 miles.

Through coöperation with the United States Geological Survey four transmitting channels have been allocated to this new type of service with the call letters of KIDD. In most instances installations have been made in standard U. S. G. S. gage houses at remote points where there is otherwise no medium of satisfactory communication.

◆

"IMPUT"

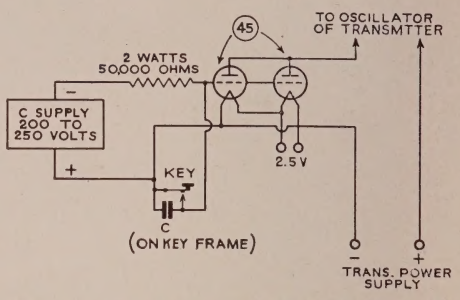
Nope—that is not an accident; we merely misspelled it in a popular way. Don't ask us why "in" should be spelled "im", but it is a fact that quite a few manuscripts received for *R/9* do speak of the "imput" to a set or an amplifier, when of course "input" is meant. In speaking to the editors of several other radio journals we find they have the same experience. Please, Mr. Contributor, Sir, will you remember that we put things "in" and not "im"? Thank you.

◆

By taking the two units from a pair of the new "crystal" earphones and shielding the leads, one has *two* crystal microphones. Of course they will take considerable pre-amplification, but the quality is nothing to be sneezed at.

A Break-in Keying Scheme

By H. C. EICHELBERGER*



The voltage of the C supply should be between one-third and one-half the plate voltage used on the keyed stage. The arrangement shown will key an input of 550 volts at 120 mils. If over 1000 volts is used on the keyed stage, UX250's should be substituted for the 45's.

Since wanting to work breakin on my own frequency, and also being quite thoughtful of keeping on speaking terms with my neighbors, I find keying not exactly simple.

In order to work break-in on your own frequency it is, I think, necessary to key the oscillator. Key the negative lead direct and your neighbors frown, and your signals have a decided chirp. Put in a condenser and choke and your "sigs" get tails that make them hard to copy.

I finally dug in the junk pile and built up a tube keying arrangement at no immediate expense which is proving very satisfactory. This consists of a pair of 45 keying tubes in the negative oscillator lead, biased to more than cut-off, (by an old discarded receiver B supply) through a 50,000 ohm 2 watt resistor. The key shorts this bias at the 45 keying tubes and handles only current that passes through the 50,000 ohm resistor, which is less than one milliampere. Even with this small amount of current, a slight click will be heard in a receiver, so it becomes necessary to put a small condenser across the key. This capacity is not critical. From .002 to 0.25 will do the trick. Too large a capacity here will give the signals a tail because of the small amount of current flowing through the 50,000 ohm resistor having to charge this condenser before cut-off is completed. *Be sure to mount this condenser on the key.* A foot of wire here

[*Continued on Page 46*]

*R. F. D., Boise, Idaho, W7EMT.

EA4AV

Although EA4AV is located 5000 miles from the land of the stars and stripes we find a surprising resemblance between our American stations and that of señor Esteban Muñoz Diaz of Madrid, Spain. We say surprising and we mean just that. In all the photos yet seen of European stations there was a certain atmosphere which immediately conjured up visions of far away countries bespeckled with medieval castles amid black forests. EA4AV might be your station and it might be mine, it is so typically American in every detail.

EA4AV's string of dx achievements is an envious one; however we do not give all credit to the American gear, knowing through experience that the operator is responsible for just ninety-nine per cent of a station's results. Our hats are off to you, Señor Diaz, and we are proud that you chose our equipment for your station.

The transmitter is the familiar breadboard layout using three crystal controlled stages. In the oscillator a 59 tube is used in the usual "tri-tet" arrangement. A Weston milliammeter serves the dual role of plate meter for this stage, and, by a plug-in system is transferred into the grid circuit of the following stage. Two crystals are used: a 7 mc. plate does the work for twenty meter operation while an eighty meter "rock" does duty on forty meters.

In the intermediate amplifier an 800 tube is used as a "straight" amplifier on both bands. This insures plenty of excitation on either frequency and is certainly a contributing factor to the success of the station. Plate potential for this stage is derived from the final amplifier power supply through a dropping resistor giving 900 volts on the plate of the 800. Another Weston meter is in service in the plate lead and under operating conditions measures approximately 125 mills. Gridleak bias is used throughout the transmitter as batteries were found too bulky when enough were used to give the high bias so necessary to peak efficiency.

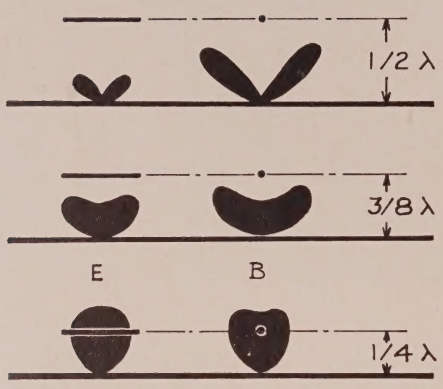
One 203A tube does duty in the final amplifier. On the plate EA4AV has 1250 volts derived from a high voltage transformer and a pair of mercury vapor half wave rectifiers. The usual brute force filter is used. To the copper tubing inductance we find a half wave forty-meter zepp. coupled in the usual manner, and with 150 mils. on the plate of the tube the zepp. feeder current is two amperes. The two frequencies used are 7190 and 14,380 kc.

So much for the transmitter that pounds out the wicked signal we have become so accustomed to hearing in this country. For a receiver Señor Diaz uses a National SW3 with bandspread coils and a pair of Brown's adjustable reed phones. Diaz seldom has difficulty in making a good one hundred per cent copy, and this ability, coupled with his splendid "bug" operating, makes working him a genuine pleasure.

ANTENNAS

A $100 Sky Wire, or QRO?

By W. W. Smith



Showing both vertical and horizontal directivity of horizontal half wave antennas at different heights above earth. Note that even at ½ wave off ground the directional properties of the antenna are not particularly marked.

Amateur transmitting antennas are much like the weather in that everyone talks a lot about them, seldom does anything about them, and never knows just exactly what to expect from them. We are still using "gas lamps" in so far as our antennas are concerned. A hasty survey shows that approximately 80% of the amateurs are using single wire fed, Marconi or antenna-counterpoise (160 meters), "zepp.", or doublet (center fed) antennas, fundamentally the same types as were popular 8 years ago. There is nothing wrong with these antennas; it just pains us to think we know little about transmitting antennas suitable for general use that we did not already know in 1927. Or is the trouble that we don't use all the knowledge that we do know about these antenna systems?

We are going to deal only with antennas for the 20, 40, 80, and 160 meter bands, as the ultra-high frequency bands constitute a distinct problem and require separate treatment. Also, we are going to assume that you want good, general-coverage communication rather than "point-to-point" transmission in one direction only. Excepting possibly for 20 meters, a rotatable beam antenna is out of the question for amateur practice on the above mentioned bands. Any *effective* beam antenna therefore restricts transmission to one particular direction, which is not so good.

Most beams seem to give an actual power gain of about 8 times at most, which is only 1½ "R's" on the old (may it never perish) 1 to 9 scale (taking the commonly accepted interpretation of 1 "R" as 6 db.). Theoretical gains of more than 8 are possible, but hard to obtain except with an elaborate array or a "long-leg diamond". The only way to get a worthwhile power gain is by confining the radiation to a very narrow beam, and then QSO's are restricted to a small area. If the beam is broad enough to take in a fairly good "hunk" of the map, there will be but little power gain and the increase in signal strength will not be apparent by mere listening.

A few weeks listening to "antenna gab" on the 20 meter phone band revealed some startling things. In the first place, it was noticed that the boys with vertical half wave antennas (theoretically the "berries" on 20 meters) do *not necessarily* put in a louder signal than stations with the same amount of power in a horizontal doublet. Another disconcerting discovery was that the boys on the west coast with their "rotatable bird cages" could oftentimes spin their contraptions in a 360 degree arc and stations in the east reported that the "R meter" *did not know the difference* on their receivers. Ten miles away from these same rotatable beams the meter on a receiver would vary by two "R points" as the array was swung in a circle, indicating a difference in power ratio of 16 to 1.

One amateur in the eastern part of the country went to the trouble of putting up both a vertical and a horizontal half wave doublet to see which of the two gave the better results. The feeders to the two antennas were fixed to permit instantaneous change from one to the other. One evening we heard the station R8 on the vertical, R3

when he changed to the horizontal. Another time we heard him fade completely out about 9 p.m., p.s.t., when using the vertical antenna. Five minutes later he was putting in an R7 signal—on the horizontal antenna. This convinced us that the angle of radiation in the vertical plane is of much more importance than horizontal directivity. For this reason, and because most amateurs are willing to sacrifice an "R" to be able to talk in all directions and not just one, only general coverage antennas will be discussed.

The Expensive "Cheap" Antenna

Did you ever stop to consider what a small percentage of the total expenditure invested in the station (both time and money) is represented by the radiating system of the run-of-the-mill amateur station? We know of 1 kilowatt stations, costing upwards of one thousand dollars, that are sporting antenna systems that cost less than $10 to erect. Certainly the antenna *may* be a good one even if it did cost but $10 worth of wire, wood, insulators and nails. But decibels get more and more expensive as the power goes up, a 3 db. loss representing 500 wasted watts at the 1 kilowatt level. For that reason it seems any 1 kilowatt station would be perfectly justified in spending at *least* $100 on the radiating system. A good antenna costs almost as much for 5 watts as for 1000 watts, this being a fixed charge. But with our 5 watt station it would be more economical to raise the power a bit rather than spend all the $100 on antenna. The amount of cash that can expediently be spent on the antenna system (percentage of the total cost of the transmitter) will vary with different locations, running from about 10% for a good location to about 20% for a poor location. In a bad locaton we judiciously may spend more money to get our antenna "above the mess".

To give you an idea of how a few dollars may be spent to great advantage on improving an antenna system, let us cite a few examples:

The station in question was using ordinary twisted no. 14 rubber covered for a "twisted pair" transmission line to a half-wave, horizontal Hertz. A sensitive field strength meter was set a couple of hundred yards from the antenna and the feeder was then changed over to "tailor made" 72 ohm feeder cable expressly designed for the purpose. The cable cost $4.97 including postage and tax. The current-squared thermo-milliammeter in the field meter went up 42% when the input to the transmitter was adjusted to the previous value. The station was made up of some $200 worth of radio equipment (not including the receiver). And for $4.97 we increased the radiated power by 42%!

In another case, substituting really good manufactured spacers for "oiled wood" spacers on a zepp. increased the power by 57%, at a total cost for spacers of $2.40.

Another ham we know spent $3.50 for materials to make a good, low resistance ground, and bought $2.50 worth of insulators to break up the guy wires on the poles holding his 160 meter Marconi. His reports immediately went up one "R", indicating an effective power gain of about 4 times.

While on the subject of taking average reports as a basis of comparison, we will admit that it is not an extremely accurate method of comparing results. But neither can we always go by the field strength meter.

The "Lying" Field Strength Meter

As far as indicating how much power we are putting into a distant point, the field strength meter is as big a liar as the antenna ammeter. . . . *when changes are made in the antenna itself.* If we are merely fiddling with the feeder system, a field strength meter or an antenna ammeter will tell us how much more or less we are putting out. But when changes are made in the antenna itself, it is a different story. Remember when we raised the height of the "antenna" portion of our old antenna-counterpoise radiator and our reports went way up—in spite of the fact that the increased spacing between the two halves of the antenna caused the antenna current to drop 30%? The same holds true with our field strength meter. It is o.k. to check the effectiveness of different feeder systems when working into a given antenna, but n.g. for checking different antennas or changes in the antenna itself (radiating portion). One antenna may have a strong ground wave, or low angle radiation, and give a much greater indication on the field strength meter even though it may produce less signal strength 1000 miles away than another antenna that gives a lower reading on the field strength meter.

"Angle" Radiation

This brings us to the problem of deciding upon the angle of radiation most desirable for our particular use. By using a half wave vertical radiator, or a high-harmonic horizontal radiator, we can get strong low-angle radiation in all directions. By using a half wave horizontal antenna placed approximately ¼ wave above the "effective earth" we get strong high angle radiation in all directions. By using a half wave horizontal antenna approximately ½ wave high, we can get "intermediate angle" radiation, but with slight directivity (maximum radiation broadside to the antenna). The best way to get non-directional "intermediate angle" radiation would be with a full wave vertical radiator, but such an antenna is out of the question on the lower frequency bands. We are assuming, of course, that there are no power wires, unbroken guy wires, or neighboring b.c.l. antennas to distort the pattern appreciably. More on this later. As for the "effective ground", it may be figured accurately enough for all practical purposes when planning antennas for 7 mc. or lower frequencies as "about where the permanent moisture starts".

Well, now that we see how to control, to a certain extent, the angle of maximum radiation, how do we know whether we want high angle or low angle radiation, or some of both, or something in between? No hard and fast rules can be laid down here. The best we can do is to make some broad generalizations that will hold in most cases most of the time under most conditions.

Experience has shown us that as we go higher in frequency, the less the waves are "bent" by the refracting layers, so that when we get down to 20 meters it is necessary that the radiation be at a fairly low angle to do much good. 20 meter waves starting up at an angle approaching the vertical never return to earth. Experience has shown that on the "medium high" frequencies (40 to 160 meters) most all waves except those going straight up are finally shot back to earth. On these bands we find that low angle radiation on one band is approximately equal to high angle radiation on the next higher frequency band. For instance: with the same power, we can put *about* the same signal into a point 2500 miles away with low angle radiation on 80 meters as we can with high angle radiation on 40 meters.

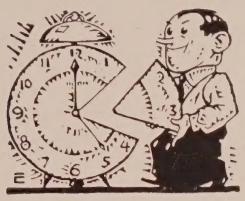
Generally speaking, it is better to pick the frequency and angle of radiation that works best for a given distance at a given time of day rather than attempt to "shove" the signals into a place by mere brute force. A transmitter that can be easily and quickly changed from band to band is worth more than a station with 10 times the power but limited to one band either by transmitter design restrictions or inability of the antenna to work satisfactorily on more than one band. This means an antenna that will work effectively on all bands, giving a fairly high angle of radiation on 160 meters, medium angle on 80 and 40 meters, and low angle radiation on 20 meters. Why do we want high angle radiation on 160 meters? Because it puts in a louder signal 100 miles away. If the station is 500 miles away it can be worked best by going to a higher frequency rather than by going to low angle radiation on 160 meters.

Two Simple All-Band Antennas

About 260 feet (not extremely critical) of copper clad wire (such a span of ordinary copper wire would stretch badly when pulled reasonably tight) as high and as much in the clear as possible, zeppelin fed at one end with a feed line boasting *good* spacers, will make one of the best "all band" antennas that one can put up. The feeders may be of any length, and either loaded or series tuned to hit any band. At 160 meters, most of the radiation will be at a rather high angle (the antenna being less than ⅜ wave above earth) and will show little directivity. Half wave horizontal antennas do not begin to exhibit their "figure eight" directivity pattern to any great extent until they are *raised to more than one half wavelength above earth.* (See figure 1 and the appendix to this article.)

On 20 meters the radiation of this "all band" antenna is quite low, the radiating portion working on the 8th harmonic. On 40 and 80 meters the angle of radiation is intermediate. Experiment has shown this antenna hard to beat on any band for general coverage use. Note that zepp. feed is the only type of feed that can be used. No other system of feed will work properly on

[*Continued on Page 56*]



BEST TIMES FOR FOREIGN RECEPTION

The tabulations in this department indicate the best time for contacts between any given countries. This information was gathered direct from amateurs in the countries listed. Due to varying conditions the times given in these columns will change slightly from month to month, and the corrected lists will be published in succeeding issues. The hours given merely indicate the times that our contributors are on the air and are able to receive the continents listed. It does not mean that these are the only hours that reception can be expected. All times are given in G.C.T.

We are indebted to the following amateurs for their assistance in compiling this data: (G)2AFA, CT2BK, OE-059, OE-001, LU1CH, ZL241, G6ZU, (G)2ANT, PK3LC, BERS-195, SU1SG.

ARGENTINA

14 mc.

Asia	0700—0900
Europe	2000—2300
North America	0700—0900
Oceania	0600—0900

NEW ZEALAND

Europe	0630—0730
North America	0630—1030

BRITISH ISLES

3.5 mc.

North America	0000—0600

14 mc.

Africa	1600—1800
Asia	Irregular
North America	1200—0000
South America	2200—0800

EGYPT

7 mc.

Europe	1600—2200
North America	0400—0600
South America	0400—0600
Oceania	0400—0600

14 mc.

Europe	0900—2000
North America	1800—2200

AUSTRIA

14 mc.

Signals from all over the world are heard between 1400 and 1600.

7 mc.

Africa	1900—0100
Asia	1800—0200
North America	2200—0800
South America	2200—0800
Oceania	2000—2200
	0600—0800

3.5 mc.

North America	0000—0700

DUTCH EAST INDIES

7 mc.

Africa	0000—0200
Asia	2300—0200
Europe	1300—0700
North America	1700—0000
South America	1700—0000

AUSTRALIA

7 mc.

North America	0730—1630

14 mc.

North America	2100—0500
	1100—1300

GERMANY

7 mc.

Africa	1700—2200
Asia	Not Heard
North America	2000—0200
Oceania	2000—2200
South America	Irregular

14 mc.

Africa	1000—1200
Asia	1100—1400
North America	1300—1700
Oceania	1300—1500
South America	1500—1800

◆

DX NOTES

Mr. Henry B. Shields, British and Colonial Director of the Society of Wireless Pioneers, has offered to listen for and conduct tests with any amateur in the world. He should be addressed at 35 Bluestone Road, Moston, Manchester 10, England. Complete data should be furnished regarding frequencies, time, type of transmission and any other distinguishing characteristics that would help Mr. Shields identify your signal. The transmitter operated by Mr. Shields transmits with the call NB1. It is a member station of the Royal Naval Wireless Auxiliary Reserve with an assigned frequency of 3830 kc.

◆

Madeline McKenzie, 11 year old Australian y.l., recently passed her operator's proficiency examination with a high average. She is the daughter of VK4GK. Because of

[*Continued on Page 60*]

A "LOCAL" PHONE

Easy and Inexpensive to Construct

[It looks as if the F.C.C. may finally start enforcing the "minimum power to carry on satisfactory communication" clause. Using 500 watts to talk across town is really a hoggish and unnecessary practice. 5 or 10 watts of carrier is all one needs to talk up to 8 miles or so on 160 meters. And, if your antenna is any good, you still will be R9.

Rather than incorporate a "QRP switch" in their high power rigs, some amateurs will prefer to save the filaments on their 203A's and use an auxiliary transmitter putting out just enough power to shove a respectable carrier into the suburbs (or into town if you live in the suburbs). Such a rig is described in the following article. It is also suited to the newcomer who wants to take an actual "fling" at working phone to see if he is going to like it before spending hard earned $$$ for a high power phone rig.]

◆

When the 20 meter band was first opened to telephony some years ago and class B modulation was still sealed up in textbooks, a group of enterprising 20 meter enthusiasts (mostly c.w. men desirous of taking a fling at dx phone) took the old idea of using a vacuum tube for grid *leak* modulation, and for some time had much fun working foreigners by the dozen with voice. One ninth district station, particularly outstanding, worked 19 countries with such an arrangement, modulating the two 210 tubes in his final amplifier with a single 201-A. Of course this station had an ideal location and an excellent antenna.

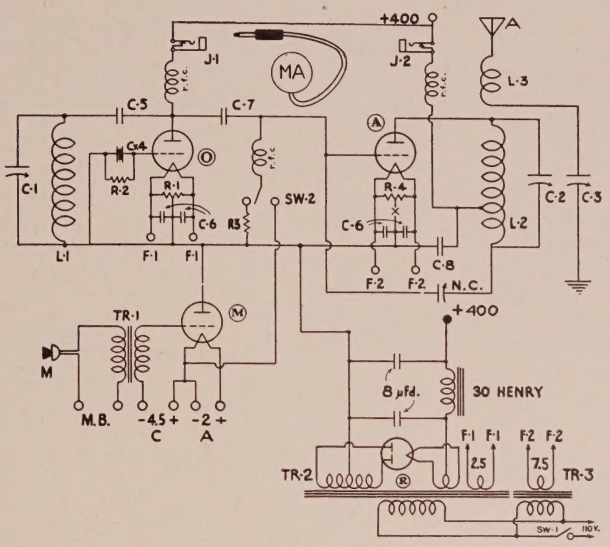
The stations did not sound half bad at 70% modulation, though the "gargulation" was nothing to rave about when higher percentage was attempted. At 50% modulation the quality compared favorably with plate modulation.

Hmmmmmm . . . 50% modulation. But are not most of us overmodulating anyhow? It is *so* easy to overmodulate when using class B plate modulation. The quality sounds about the same to the average ear, and the only indication of overmodulation is the fact that you spread all over the band. With something that starts to distort noticeably when the modulation is run up to the QRM point, we would be aware that we were overmodulating. And anyhow, 50% modulation is pretty good modulation; it doesn't sound *much* weaker than 100% modulation of the same antenna power.

These things, coupled with the fact that the tube-gridleak method of modulation is about the utmost in simplicity, caused us to choose this type of modulation for a small, low power "across towner" for 160 meters. Judging from all indications, amateurs must soon become "QRP conscious" on local QSO's; there always has been such a regulation, but it looks as if the F.C.C. is really to make an attempt to enforce it.

The little "intracity special" is shown in the accompanying diagram. A good portion of the parts will be found in every ham's junk box, and the remainder may be purchased for but a very few dollars. It puts out a 15 to 20 watt carrier that sounds very acceptable at 60% modulation, though the pattern may not look exactly symmetrical on the screen of an oscilloscope. Even with a slight tendency towards lop-sidedness (it does not become really pronounced until the percentage is run up above 70%) the QRM produced by this little rig is infinitely less than that created by 187% modulation of a 200 watt rig with its 830-B modulators.

While on the subject of reducing power to limit QRM when one is working short distances, it is interesting to note what a *tremendous* reduction in power we must make to result in any appreciable difference. One ham we know of is very considerate. When working local stations, he cuts his power input from 600 watts to 150 watts. This is a decrease of *only 6 db., or about one "R" on the 1 to 9 scale.* In other words, if he was pumping 12 "R's" worth of QRM into a receiver 100 miles away while working across the backyard with 600 watts input, cutting the power to 150 watts input would drop the QRM only to R-11, and the station 100 miles away would have practically the same difficulty in receiving other signals on that frequency. To give an 18 db. reduction in signal strength (materially cutting down QRM out of town but leaving plenty of signal to rattle speakers for 20



L-1—35 turns no. 20 d.c.c. on 2 in. form
L-2—40 turns no. 20 d.c.c. on 2 in. form, tapped at 20th turn (center).
L-3—10 turns no. 20 d.c.c. on 2 in. form
C-1, C-2—.0001 μfd. midget variable (Hammarlund Star)
C-3—.00035 to .0005 μfd. receiving type variable.
Cx-4—160 meter crystal (good one!)
C-5, C-6, C-8—.002 μfd. fixed mica
C-7—.0001 μfd. fixed mica
N.C.—.000025 μfd. (25 μμfd.) midget variable
J-1, J-2—Closed circuit jacks for reading plate current
R-1—Center tap resistor, 20 ohms
R-2—10,000 ohms, 3 watt carbon (must not be wire wound)
R-3—10,000 ohms, 3 watt or larger
R-4—Center tap resistor 50 ohms
TR-1—Microphone transformer
M—Microphone (see text)
TR-2—Power supply transformer, 350 to 400 volts each side of center at 125 ma. rating; also 2½ volt winding.
TR-3—7½ volt filament transformer
MA—0-100 ma. d.c. meter
M.B.—Microphone battery (same 4½ volt battery may be used both for microphone current and bias).
O—Oscillator tube, type 46 class B connected (grids tied together at socket and worked as single grid).
A—Amplifier tube, receiving type 10
R—Rectifier tube, either type 5Z3 or 83-v
M—Modulator tube, type 30 (or 19 for more gain)
RFC—Hammarlund CH-8 radio frequency chokes (most other types tried n.g. on 160 meters)
Filter condensers are 600 peak volt rating electrolytics.

miles around) it would be necessary to cut the power to about 10 watts input!

In the form of grid modulation used in the transmitter described in this article, the modulator tube acts as a varying voice-controlled gridleak. No speech amplifier is necessary, and when a "French handset" single button mike is used, or the type put out by Stromberg Carlson (model no. 6), the quality is sufficiently good to give one a pleasant surprise. If more gain is desired, so that one may either talk farther from the mike or talk in a lower voice, a type 19 tube may be substituted for the 30. The two elements of the 19 are connected in parallel (grid to grid, etc.) and the bias reduced from 4½ to 3 volts.

Antenna

The coupling system shown is designed for use with a 135 foot wire (as high and in the clear as possible) worked against a waterpipe ground. If the ground wire is over 10 feet from the transmitter, it will be necessary to subtract a foot of antenna length for each extra foot of ground wire length. If a ground connection cannot be made with a ground wire of less than 25 or 30 feet, another type of antenna should be used. If you already have up a good 160 meter antenna that you are using with a larger rig, it is a simple matter to adapt the coupling system on the smaller transmitter so as to make possible the use of the regular antenna on the little rig by the mere throw of a switch.

Microphone current may be obtained from the filament battery for the 30 (or 19) tube. If slightly more voltage is desired on the mike, the "C" battery may be used for microphone current.

The two tank coils, L-1 and L-2, should be spaced at least 12 inches, and should be mounted at right angles to each other. Shielding would be the best bet, but is not absolutely necessary.

The antenna coil, L-3, should be mounted on a swivel to facilitate coupling adjustment between it and the 210 plate tank coil.

The neutralizing condenser, N.C., should be provided with an extended bakelite shaft (or wooden dowel) about 6 inches long to cut down body capacity.

By throwing the switch SW-2 to the left hand position (thereby cutting R3 into the circuit) and placing a key at the point "X" in the 210 filament centertap, the transmitter may be used for c.w. work on U.S.N.R. "skeds," etc.

Power Supply

The power supply transformer TR-2 is a husky one of the receiving variety. These transformers do not ordinarily have a 7.5 volt winding, nor enough spare windings to connect in series to make up 7.5 volts. Therefore the 210 is heated by another transformer, TR-3. Sometimes the cheapest thing is to buy another "midget" plate-supply transformer and connect a 5 and a 2.5 volt winding in series. Instead we rewound a transformer that used to supply a tungar rectifier. The original secondary was replaced by one of no. 18 enameled wire, using enough to deliver 7.5 volts with the 210 connected. For our transformer this took 45 turns.

The filter condensers are of the inexpensive dry electrolytic type. The two in this case were mounted in a single cardboard unit. They are commonly called "dual eights".

The filter choke should be rated at 125 ma. or more, and should not have too much resistance. About 300 ohms is the limit; more resistance will cause too great a voltage drop.

Tuning

Tuning up is just a matter of 10 minutes, unless you have to run down to the corner drug store to procure extra flashlamps. Sneak up on the coils with the flash lamp indicator (a 3.8 volt flashlight bulb connected to a 2 turn, 2½" diameter loop of hookup wire) gradually, and don't bring the indicator anywhere near the coils until you first make sure that the oscillator is oscillating. Most bulb fatalities are due to the oscillator breaking into oscillation with a bang after the bulb is stuck right over the coil in an attempt to get an indication.

First insert an open phone plug (not connected to anything) into the jack J-2 in order to open the plate circuit to the 210. Then, with all tubes in their sockets and the milliammeter plugged into J-1 to read oscillator plate current, rotate C-1 until the meter jumps up from its non-oscillating value (around 8 ma.) to 35 ma. or so. Then slowly rotate C-1 towards maximum capacity (the plate mils. decreasing) until the stage goes out of oscillation, as indicated by the plate current dropping suddenly to 8 ma. again. Then back off the condenser slightly from the point where the oscillator "breaks". If the point at which the oscillator "breaks" does not come at the same condenser setting when approached from both directions, the crystal and the holder should be suspected of not being "up to snuff". Using as much capacity as is consistent with stability, we may now go from the oscillator to the 210 neutralizing condenser. Coupling the lamp indicating loop to the 210 tank, rotate C-2 until the lamp is brightest. Now rotate N.C. until it goes out. Then repeat the process a couple of times, until it is possible to put the loop right over L-2 and slowly swing the condensed C-2 though resonance without the lamp glowing at any time. The stage is now neutralized, and as the setting will hold pretty well over the whole 160 meter band, it is never necessary to touch N.C. again . . . or at least until it is jarred out of adjustment.

Antenna resonance is found with C-3; antenna coupling is varied by adjusting the position of L-3. Excitation to the 210 may be varied (within limits) by adjusting the oscillator tank condenser, less capacity cutting down the output of the oscillator and thereby reducing the excitation to the 210 stage. The plate current to the 210, as read with the meter plugged into J-2, should always be at the "bottom of the dip" on condenser C-2, regardless of all other adjustments. This should be the final touch in tuning the transmitter, as the point at which minimum plate current is obtained will vary slightly with other adjustments.

Gradually talk louder, or closer, to the microphone until distortion (as heard in a monitor) becomes noticeable. Then either back away from the mike just a hair or lower your voice a couple of db. and the rig is all set to go.

After the rig has been in operation a while and one becomes familiar with the adjustments, it may be found that more output or a higher percentage of good-fidelity modulation may be obtained by certain adjustments

of excitation and loading of the 210 stage. To determine the relative carrier output strength, a flashlamp may be put in series with the ground connection, with just enough no. 20 bare copper shunting the lamp to give a moderate glow under average conditions. More indication on the lamp means more carrier, but it may not mean more voice strength at the other end. To determine the relative voice strength and distortion, the monitor is an absolute necessity. It may be nothing more than a coil, variable condenser, crystal detector, and a pair of earphones, but some means of checking the *audio* component of the carrier is necessary.

On c.w. we tune only for maximum indication on the antenna flashlamp, keeping one eye on the 210 all the while to see that it does not get too red. About 20 to 25 watts can be obtained on c.w. at the plate voltages shown.

A transmitter similar to the one described has been used by George Hart, W8GCR, for some time. It uses the type of "gridleak modulation" incorporated in this transmitter, and has performed very satisfactorily, considerable dx having been worked in addition to local QSO's.

◆

MODULATION NOTES

The "surging" plate current pulled by a pair of class B modulators does lots of funny (and sometimes rather disconcerting) things. If the same plate supply is used for both the modulator and modulated stage, we can tell absolutely nothing about our modulation percentage from the degree of activity of the antenna ammeter. A pure, steady, voice tone producing 100% modulation would (symmetrical modulation envelope and no carrier shift) ordinarily drive the antenna current up about 17%. But at 100% modulation the increased plate current to the modulators causes the plate voltage to drop from 5 to 15 percent (depending upon regulation). So, instead of rising 17 percent, the antenna ammeter either goes up just a hair on a sustained 100% modulation tone or stands still. Willie Wizeguy takes a squint at the antenna ammeter and tries to whistle it up 20% or so. It goes up only 5%, and, horrified, Willie cranks up the gain in an attempt to "bobulate" 100%. As he winds up the gain and modulates harder, the plate mils on the modulator kick up more, and the plate voltage drops more and more on a whistle. When he finally runs up the gain enough to enable him to whistle the r.f. current up 17%, the plate voltage on the final has dropped probably 20% or so during the whistle, the negative peaks are being clipped over about one quarter of the audio cycle, the positive peaks hit 547%, the modulator tubes groan in agony, the harmonic distortion is around 35%, and the signal takes up half the band on a good super or two-thirds of the band on a poor one. Willie notes with satisfaction that he is now modulating "100%" and proceeds to clutter up the band with a CQ.

Great is Willie's indignation and disbelief when someone with a "scope" informs him that he is unable to give Willie the dope on the pattern of Willie's modulation because it "flies clean off the screen".

If a modulator is a small one (in comparison to the modulated stage) or if the modulated stage has not a super-abundance of excitation, Willie may be unable to make the antenna current climb 17% regardless of how hard he yells. But the peak-clipping and harmonic distortion will be there just the same, causing a fuzzy and broad signal.

What's to be done about it? First, improve the regulation of the power supply that feeds the modulators and modulatee. If the plate voltage varies more than 6 or 7 percent under modulation it shouldn't be used for class B anyhow, unless you are willing to sacrifice quality. Second, do not attempt to ascertain your modulation percentage by the increase in antenna or tank current. Either check it on an oscilloscope or rig up a "negative peak clipping indicator" as described in the April issue of *R/9*. Really these methods should be used even when separate power supplies feed modulator and modulatee, but their use is doubly important when a single supply is used.

And here is something that can happen regardless of whether the class B modulator has its own separate power supply or not—if the modulator is a high power one and the regulation of the 110 volt line going to the shack is none too good. It is particu-

[*Continued on Page 46*]

A MOBILE ANTENNA

Of the Single Turn, Loop Type

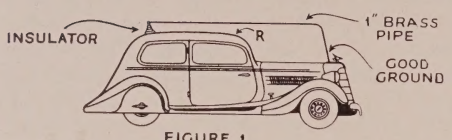


FIGURE 1

This antenna system, on a smaller scale, should make an effective radiator for 10 meter mobile, if and when the band is opened for such use. The one shown above will resonate only at lower frequencies, because of the length of the loop, and therefore is adapted (for the present, at least) only for commercial applications. By terminating the "hot" end of the antenna at the point "R" instead of running it to the back of the car, the antenna can be made to resonate at 10 meters.

Good 2-way communication is possible with a 1-turn vertical loop antenna such as sketched herewith. Even in the 3500 kc. range with but 10 watts or so of power there *have* been 150 mile voice and c.w. telegraph "contacts" with such loops to a fixed station at the other end—not recently that we know of, but in the course of experimental work at various past times. At higher frequencies the 1-turn loop becomes more effective, of course, though it will not work at such high frequencies as its size might suggest, because of the proximity of much metal which raises the capacity greatly—250 to 700 μμfd. depending on car and conditions. Since you can't hope to get up much voltage across such a capacity (or across the small inductance offered by the piece of pipe) this is clearly a high-current low-voltage antenna. Insulation is not so vital, accordingly, but good contacts are basically essential. In fact it is perfectly appalling how good they must be. Going all over the car and bonding everything together with copper ribbon is worth while—and how! The job is much easier if one starts with a steel-body car built by Ford, Chrysler, Hudson-Essex, or Studebaker. These jobs are welded and there are no "maybe" contacts except at doors, hood and fenders, which are easy to get at and jumper. In one car of metal-and-wood type thorough jumpering raised the antenna current from 1 to 2.5 amperes, representing 6¼ times as much radiated power! In figure 1 the "insulator" is the leadin, through the car's roof. Do a good job to avoid leaks; we mean *water* leaks.

The queer diagrams of figures 2 and 3 have a reason for existence. It is this: We can't use an ammeter to find antenna resonance because the meter itself has too much R and ruins the result. Yes, current values were just given but they were obtained by means of a special current transformer feeding a vacuum tube ammeter which is a thoroughly costly gadget.

If you ever tuned to a capacity coupled antenna by plate meter alone you may remember that it was perfectly hopeless to (1) get the tank coil of the final amplifier tuned to the frequency, (2) to resonate the antenna at the same time, and (3) to finish up with the right plate current, and to *know* that this has really happened. It just can't be done with only a plate meter unless one splits up the antenna coupling condenser into two pieces (C_1 and C_2). Of these C_1

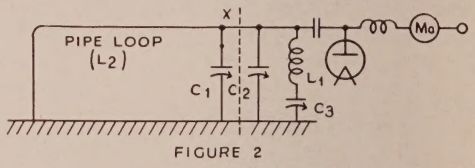


FIGURE 2

Two ways of connecting the "antenna" to the transmitter for adjustable loading.

tunes the antenna to the desired frequency (circuit open at X). A small oscillator with a grid-current meter is handy to check this by "grid dip". One is shown in figure 3, and is easily understood except for C_C which is a tiny coupling condenser of 2 insulated wires merely *hooked* together. L is chosen to cover your desired wave. Carry the test oscillator to within 10 feet or so of the transmitter and poke the key—oh, use a 10 foot stick; where's your ingenuity? Set the test oscillator for the greatest grid-meter shift. That is, resonate it to the driver of the transmitter. If necessary tune up the output tank L_1, C_2, C_3 to get enough "hop". That *can* be done by plate meter only.

Now carry the test oscillator (don't shift its setting) back to the car and clip the C_C lead to the loop. Turn C_1 until the test

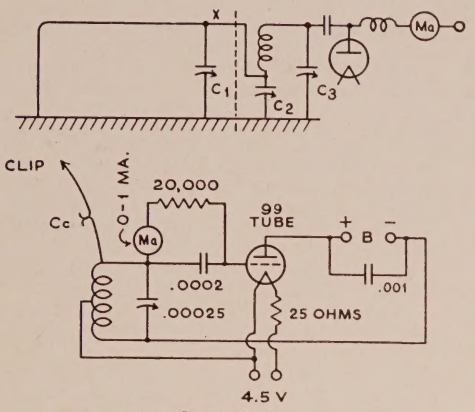


FIGURE 3

Test oscillator for preliminary tuning of antenna circuit to operating frequency.

oscillator says the loop is resonant. If you find no resonance clip to a different place on L_2 before using a larger C_1.

Now—the loop circuit L_2C_1 is pretty nearly in tune with the transmitter. You can now close the circuit at X and if everything is o.k. the amplifier will *not* require retuning. Usually a *small* change in C_3 or C_1 is necessary.

If the tube's plate current is too small the coupling must be increased. This is done by opening X and re-resonating the L_1, C_2, C_3 circuit with more capacity at C_3 and less at C_2. It may be necessary to short up some of L_1.

The two circuits are essentially the same, both being the old familiar Western Electric broadcast station method of antenna coupling. One wonders why it gets called an "impedance matching circuit"; any antenna coupler must do *that*.

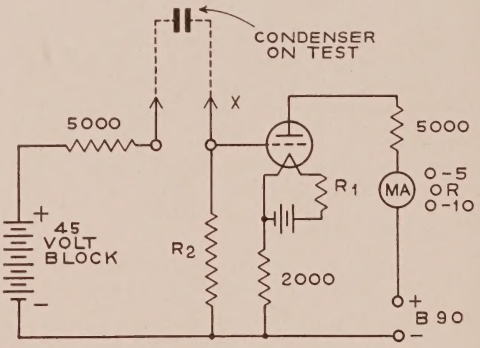
As for constants, all condensers can be of the broadcast receiving sort (though a soldered-brass type is best for C_1), the coil L_1 of perfectly normal construction, with a clip to short some turns. C_2 will generally be set much higher than C_3 to get proper tube load.

Why not use ordinary inductive coupling and avoid these funny adjustments? O.k.—if you can show us an antenna coil of a resistance as low as the pipe loop! By the way, C_1 needs a *good* jumper from frame to rotor.

CONDENSER TESTER

The better a.v.c. (automatic volume control) systems all use very high resistances (½ to 4 megohms) in the bias system. Bypassing these resistors are numerous condensers, slight leakage in any one of which will cause the a.v.c. to work badly.

But the condensers will test "perfect" by any of the usual tests! One needs a test which will expose a high-resistance leak without the necessity of using a high voltage. The diagram shows such a test-circuit. The sensitivity can be changed by using more or less resistance at R_2. The circuit will expose even a very high leakage resistance; hence do not be too quick to condemn. Try a lot of condensers and see what meter movement is permissible on a "good enough" condenser. Take care that only the test condenser is being tested and that it is cut loose from chassis wiring. Also use a well-insulated test prod and keep the "X" lead in the air (and off your hands). Of course



Tester for Determining Condenser Leakage

bias-lead ("a.v.c line") leaks can also be tested for after other wiring is disconnected. If one test lead must go to chassis let it be the one nearest the 45 volt block.

The normal constants are 10 megs. for R_2. R_1 may be 25 ohms for a 99 tube, 40 ohms for a 30 assuming that a 4½ volt C battery is used to light the filament. Don't use an a.c. tube.—R. S. K.

◆

Hams are not the only ones; a broadcast station in Fargo, North Dakota was "stepped on" by the F.C.C. for operating with power in excess of that allowed by their license.

CALLS HEARD

[Numeral suffix indicates "R" strength. Send all contributions to Calls Heard Editor, not to Los Angeles.]*

28 mc. Calls Heard at W9FM during May

w1av; w1avv; w1ckf; w1zb; w2aer; w2gjb; w2bhd; w2tp; w3ado; w3aqi; w3axk; w3efo; w3evt; w3fed; w4agp; w4ajy; w4app; w4dhz; w4ef; w4mr; w4qy; w5aea; w5afv; w5ayh; w5bd; w5bdt; w5cpt; w5egc; w5ehm; w5ql; w5vu; w6vq; w8ccw; w8fda; w8ixs; w8yd; w9brx; w9ces; w9cyt; w9fg; w9gfz; w9jgs; w9llx; w9pk.

Bert Lythaby, (G)2AFA, 14, Rose Street, Peterhead, Scotland

March 18 to April 18

(14 mc.)

W 1agc-3; 1ajz-8; 1ak-5; 1aqh-4; 1bux-6; 1bxc-3; 1cun-6; 1dbu-5; 1dkz-5; 1dnl-8; 1dsf-4; 1duj-5; 1duk-7; 1flh-5; 1fne-7; 1foz-7; 1fpp-5; 1fs-5; 1fu-5; 1gjq-4; 1gqs-3; 1hio-4; 1hqn-6; 1htp-7; 1hwb-7; 1hx-5; 1iqz-6; 1lz-4; 1qv-4; 2auz-4; 2bhz-5; 2cnn-6; 2cpa-6; 2cto-3; 2cyn-5; 2czv-4; 2dbh-3; 2deu-5; 2dng-5; 2dtb-4; 2dwk-6; 2eea-5; 2fbs-4; 2fd-4; 2ff-3; 2fhi-5; 2fsk-5; 2fxz-3; 2gjb-5; 2gni-4; 2gox-5; 2hno-4; 2hyv-5; 2ifz-6; 2igx-3; 2oa-6; 2rs-5; 3ag-6; 3aiu-5; 2bdi-3; 3bph-6; 3bru-6; 3bzb-7; 3cdo-5; 3dsy-6; 3ebc-4; 3evw-5; 3fgb-3; 3jm-7; 3mv-5; 3zd-6; 4auu-5; 4bdv-5; 4cde-5; 4cyu-4; 6hjw-5; 8adg-5; 8azd-5; 8bfg-3; 8bkp-5; 8cna-4; 8erz-4; 8fpl-6; 8 gly-6; 8hga-5; 8jan-4; 8jjw-3; 8luq-5; 8mah-7; 9def-3; 9haq-5; 9hnv-6; 9ico-3; 9kgk-4; 9lb-5; 9rgv-6; 9sot-6; — cx1cb-4; j5ce-6; k4kd-5; ka1cs-5; lu3de-5; lu5ap-5; lu6dg-4; lu6jb-5; lu7az-7; lu9bv-4; om2rx-5; py2ae-4; — **VE** 1bb-5; 1bv-6; 1dr-5; 1et-6; 2ai-5; 2bd-5; 2dm-4; 2ca-4; 2fq-5.

(14 mc. phone)

w2ebw-7; w2goq-6.

Leonard Frohn, OE-001 and DE-0007, Wiener-Neustadt, Neunkirchnerstrase 66, Lower Austria

January 1 to February 1

(3.5 mc.)

D 4bag-7; 4bbh-7; 4bco-7; 4bda-6; 4bdg-8; 4bdr-6; 4bed-5; 4bfc-6; 4bgk-8; 4bic-7; 4bio-8; 4bir-7; 4bkf-7; 4bly-7; 4btu-6; 4bgm-6; 4cjm-7; 4hfs-7. — f3gm-8; g2bm-6; g5fu-8; g5sy-7; haf3af-6; haf3d-3; haf3mf-9; hb9w-6; hb9y-9; hb9z-6; ok1af-4; ok1bm-8; ok1bz-7; ok1om-6; ok2lo-8; ok3ls-8; pa0asd-9; pa0dc-8; pa0nw-6; pa0pf-5; pa0ta-8; sm5vv-6; sm6yc-7; sm7xy-6; sm7ya-7; sm7yg-7; sm7zq-7; ve1ft-6; ve3gg-5; ve4li-5; vo1p-6. — **W** 1dmd-6; 1ewd-6; 1exa-5; 1igd-7; 1ihx-5; 1mk-4; 1ts-6; 2cml-6; 2dat-6; 2dsl-6; 2gnk-5; 2sz-6; 3eop-5; 4bus-6; 4cfd-5; 5cwl-6; 6kkn-5; 8khs-6; 9kpf-5.

(7 mc.)

cm6dw-6; cn8alc-4; cn8mp-5. — **CT** 1aa-7; 1bg-7; 1dq-6; 1cb-6; 1at-6; 1ed-6; 1dg-5; 1kr-6; 1oh-6; 1zz-6; 2lk-6. — **D** 4bai-6; 4bbt-6; 4bgh-6; 4bio-5; 4bkn-5; 4bmi-3; 4ckf-6. — **EA** 1ac-7; 1av-7; 1ba-7; 1bf-6; 2ad-6; 3au-6; 3cq-7; 3cz-6; 3dp-6; 3eg-9; 3sp-5; 4ap-6; 4bl-6; 5ba-7; 5bl-7; 7bc-6; 8ah-6; 9ah-8. — ei5f-6. — **F** 3al-7; 3az-5; 3cm-4; 3cx-6; 3de-6; 3de-6; 8eb-5; 8fx-6; 8gg-4; 8jd-6; 8pq-6; 8su-5; 8ut-7; 8vp-5; 8vt-6; 8wc-6; 8wm-6. — fb8ia-6; ff8mq-6; fm4aa-6; fm8cr-6; fm8fd-4; fm8jk-6. — **G** 2cs-5; 2ic-6; 2kz-6; 2rf-6; 2ty-7; 5cm-7; 5cw-6; 5pp-4; 6kp-6; 6nc-5; 6nj-5; 6py-6; 6ti-6; 6tm-5; 6uo-6. — gi5ju6; gi6wg-6; hb9at-6; hb9y-8; i1am-6; i1xj-6; j2br-5; j2hg-5; j2hg-5; j2jj-5; j5cc-6; ka1cs-6; k4rj-6; lu2ed-5; lu4bc-4; lu4dc-5; lu7az-5; lz2nb-5; ch2hu-6; oh6uu-6; on2m-5; on4as-7; on4cd-6; on4ds-6; on4gu-6; on4gv-6; on5ij-5; oz2m-6; oz7at-6; oz8d-6; oz9wl-5; pa0dc-8; pa0mw-4; pa0ys-5; pa0zj-6; pk1bo-3; pk4co-6; py1aw-5; py1dc-6; am5ae-6; sp1ah-6; su1ch-7; su1ro-6; su1sg-7; sx3a-8; ti2rc-5; u1at-4; u1bu-6; u3bd-6; u3bh-6; u4lh-5; u4ml-6; u4ol-6; u5ks-6; uk3bo-7; uk6aa-6; ve2dl-6; vp5al-6; vp5cc-6; vu2al-5. — **W** 1aao-5; 1aja-5; 1apu-6; 1aro-5; 1bnj-6; 1bye-5; 1ch-7; 1dgc-5; 1dhd-6; 1dpo-5; 1dze-6; 1gf-6; 1hiu-5; 1hpi-5; 1ijc-5; 1iqv-6; 1ry-5; 1zzc-4; 2arv-4; 2azn-6; 2cvj-6; 2czv-5; 2dtl-6; 2dtr-5; 2dus-6; 2dvv-5; 2dwz-5; 2ewm-6; 2giz-6; 2hmk-5; 2htd-6; 2kp-6; 2ul-5; 3agc-5; 3bgn-5; 3bhd-6; 3bir-4; 3buh-6; 3bwe-6; 3byf-5; 3cdo-7; 3cyu-6; 3czc-6; 3dgo-6; 3eeg-5; 3ejo-5; 3oz-5; 3zd-5; 4ajx-6; 4ats-6; 4awy-6; 4bgg-5; 4brc-6; 4bv-6; 4dec-5; 5lq-6; 6hj-4; 6hjw-6; 8vkf-5; 8bqj-4; 8brq-6; 8dht-6; 8dkv-5; 8ehq-5; 8hwe-6; 8iry-5; 8lla-5; 8mju-6; 8qq-5; 8zy-55. — x1aw-5; xzn2b-6; yu7dt-6; yu7dt-6; zb1e-6. — **ZL** 1dv-5; 1hd-5; 2bf-4; 2bv-5; 2dj-6; 2mm-5; 2qg-3; 3au-5; 3dw-4; 3jr-5. — zs1z-5; zs6a-5; zs6af-5; zu5b-5; zu6p-5.

(14 mc.)

cp5hq-3; cx1cg-4; ea1ba-5; ea7ao-6; ei5f-5; ei8c-5; f8cx-6; f8eo-7; f8gg-6; fm4aa-6; fm4ab-6; fm8bg-6. **G** 2bm-6; 2kz-6; 2pl-6; 2rf-6; 2fm-8; 2fw-6; 2ul-7; 2wq-7; 2yl-8; 5bp-6; 5ku-6; 5pp-3; 5qr-7; 5vn-6; 6ay-4; 6gm-5; 6gq-5; 6lh-6; 6mm-6; 6uc-5; 6nw-6; 6qs-6; 6ri-6; 6fo-6; 6rf-6; 6rp-6; 6wq-6; 6wy-6; 6yl-6; g6yz-5. — gi5wd-6; k4sa-4; k5ag-5; la1g-6; la2w-7; la4g-6; la4u-6; oh1nr-4; oh2np-6; oh2zf-6; oh3na-4; oh3np-6; oh6nf-4; on4au-6; on4bz-4; on4dx-5; pa0az-6; pa0lr-6; sm3xj-6; sm5sx-5; sm5um-4; sm5vy-4; sm5xw-6; sm5yh-6; sm6ss-6; su1aq-5; su1sg-6; su6hl-6; sx3a-7; u1cr-4; u3cy-6; u3di-6; u3vb-3; u3vc-5; uk1cc-6; uk3bo-6; uk6sa-6; ve1dr-5; ve1ed-5; ve1ep-6; ve2dc-7. — **VK** 2ba-6; 2ic-3; 2mb-5; 2mc-6; 2ob-5; 2xv-5; 3ck-6; 3cp-4; 3dw-4; 3ep-4; 3gc-4; 3ht-4; 3kx-5; 3mr-6; 3rk-3; 3zf-5; 4ju-4; 6fo-5; 7jb-4; 7kv-5. — vp5pz-5; vu2bl-3; vu2jb-5. — **W** 1ff-5; 1ghb-5; 1iji-6; 1kp-5; 1vs-5; 2cyu-4; 2czp-6; 2dtr-5; 2fsk-6; 2fts-5; 2grw-4; 6tt-4; 8azd-5; 8bfg-6; 8jau-5. — yl2bb-6; yr5ap-5; zc6ff-6; zd2c-5; zl4ck-5; xzn2b-5; xzn2c-5; zt6w-6.

*George Walker, Associate Editor of *R/9*, Box 355, Winston-Salem, N. C., U. S. A.

Frank H. Pettitt, SU1SG, Catholic Club, Mustapha Barracks, Alexandria, Egypt

January 17 to January 30

(3.5 mc.)

W 1zzc-5; 2dtr-7; 2eil-6; 2gjf-6; 2vl-7; 3buh-5; 3ebc-5; 3ejv-6; 3ejz-7; 4bia-4; 4np-4; 6bk-3; 6hm-3; 8bti-6. — cr7ai-4; fb8c-5; j2kn-5; j2lc-5; j2lk-3; k5aa-6; lzo-5; vk3mr-3; vk5sa-3; vq4crl-5; vu2cq-5; x1bt-5; yi3fb-6; ze1jn-5; zl1lv-3; zl2gl-4; zl4fk-4.

H.E.J. Smith, CT2BK, Rua do Pedro, Homem 63, Ponto Delgada, S. Miguel, Azores

November 1 to January 1

(7 mo.)

W 2acy-6; 2auh-7; 2bod-6; 2bxa-4; 2cuq-7; 2dfw-4; 2dtb-6; 2evi-6; 2giz-6; 2gwe-5; 3anh-7; 3arn-6; 3bbb-6; 3bir-6; 3bph-5; 3buk-6; 3bwe-7; 3cxg-6; 3dok-4; 3gz-5; 3mv-6; 8anq-6; 8aon-6; 8btk-6; 8cir-4; 8cnt-4; 8cvb-5; 8dfh-6; 8een-6; 8fc-6; 8gbb-6; 9cpq-6; 9pst-6; 9usa-6.

(14 mc. c.w.)

W 2bhm-4; 2cay-7; 2ckr-6; 2gbc-5; 3adp-6; 3bja-6; 3bpy-6; 3cdo-5; 3cim-6; 3dpc-5; 3wk-5; 8box-5; 8cnz-6; 8fug-6; 8gfd-6; 8gqb-4; 8gwa-7; 8hwu-6; 8jin-6.

Miss May Mann, YL SWL-VK5EM, 24 Newman Street, Semaphore, South Australia

January 20 to February 24

(7 mc.)

W 1aao-5; 1bux-6; 2fbs-6; 2oj-6; 6cxw-5; 6flt-5; 6fzl-8; 6lnu-6; 8cte-8; 8jrl-6. — j3fk-5; k6dv-6; k6fkb-6; ka1ee-7; om2pi-5; om2rx-8; pa0ys-6; vs8aj-5; xu8cb-5; xu8rr-5.

(14 m.c. c.w.)

w1bux-5; w1cnd-5; w3cop-3; w8cra-6; f7cgv-7; f8fc-4; g2td-4; j2ce-3; j2cl-6; j2gx-6; j2hj-6; j3cg-5; j3dp-7; j4ci-5; j5ce-5; k4sa-5; k5ag-5; ka1ds-5; om2aa-7; pa0az-5; pk2dx-4; pk3bm-6; pk3lc-5; su6hl-7; vp5ab-6; vp5pz-6; vs6am-5; vu2bl-5; vu2cd-5; vu2jb-6; vu2jp-6; vu2re-5; x1am-4; zc6ff-6; zl1hy-6; zl2hw-8; zl2lb-8; zl3fg-6.

Miss Alice Bourke, W9DXX, 2560 East 72nd Place, Chicago, Ill.

February 23 to March 20

(7 mc.)

cm2fa-8; hj4hj-5; k6dv-7; k6hzi-6; k61bh-4; ve4oc-5; ve4fw-6. — **VK** 2as-4; 2ct-5; 2ec-5; 2fm-5; 2ns-6; 2ty-5; 2xj-6; 2yo-6; 3dp-4; 3dq-5; 3fb-5; 3jk-5; 3ml-5; 3us-4; 3wp-5; 3yp-5; 4bb-5; 5fm-5; 5rh-6; 5xv-6; 7rc-6.

(14 m.c. c.w.)

cm6dw-6; ct1gu-6; ea4ao-7; ei8b-6; f3mdt-5; f8ex-7; f8fc-8; f8tq-5; f8wb-4; f8wk-5; fm8bg-8; gtbm-6; g2kz-5; g2mr-6; g5bd-5; g5by-5; g5vl-6; g6nj-6; hp1a-7; oa4aa-5; oa4p-8; on4au-7; on4mx-4; pa0xg-5; ve1bv-6; ve1ee-8; vp5ac-5; x1ag-7.

Edward Johnson, W9RAB, 604 Central Ave., Faribault, Minn.

March 7 to March 18, 1935

(7 mc.)

cm2do-8; cm2mg-8; cm2op-6; cm2rp-5; hc1fg-9; k4sa-9; k5ao-8; k5ar-5; k6aja-7; k6akp-3; k6esu-7; k6hzi-6; k6jfv-7; k6jpd-7; k6kef-7; vk2ns-4; vk7jb-4; x1aa-7; x1al-3; x1az-9; x1bt-8; x1in-6; x2a-7; x2ai-8; x2n-8; x3g-6; x3z-4; zl1di-4; zl1kb-6; zl2ci-6; zl2gq-4; zl2gs-4; zl2hq-7; zl2lq-4; zl2mm-5; zl3ax-4; zp1ab-7; zt1r-4.

(14 mc.)

ce1aa-5; cx1gg-3; f8aq-3; f8fc-5; f8tq-5; d4bar-4; hp1a-6; on4au-4; on4mx-4; on4sd-4; py9ad-4; x1ay-6; x2c-6.

(14 mc. phone)

cm2an-6.

H. Eliaeson, Box 8, Motala, Sweden

March, 1935

(3.5 mc.)

fm8bg-8; ve1hd-6; w1dkr-6; w1rj-6; w1zw-4; w2gxy-5; w3bpn-6; w8ya-6.

(7 mc.)

hc1fg-6; vk4gk-4; zl2bn-4; zl2ki-4; zl4ai-5.

(14 mc.)

W 1cfy-6; 1cgy-5; 1bpx-7; 1dhe-6; 1duk-5; 1dze-6; 1epc-6; 1sz-6; 2bhz-7; 2vl-5; 2zda-4; 7amx-4; 8dld-5; 8kko-6; 8mah-6. — ff8mq-5; pk3st-6; ve1bv-6; ve1dr-6; ve2ay-7; ve2ca-6; ve2hp-5; vk3k-4; vu2gm-6; vq3kb-5; ze1jm-5; xzn2c-6; zt6k-6.

Fred E. Gilfillan, VQ4CRO, P. O. Box 460, Nairobi, Kenya Colony

January 2 to March 2

(14 mc.)

W 1af-5; 1aqh-5; 1avv-6; 1bux-7; 1cmx-6; 1dld-7; 1ewd-4; 1fm-5; 2bhz-7; 2bvj-7; 2cpa-7; 2dng-5; 2el-6; 2gqs-4; 2gvz-6; 2gw-7; 2hpl-6; 3aie-5; 3air-5; 3buy-6; 4bdv-3; 4cen-7; 4eg-6; 4ft-7; 5cen-6; 6grl-5; 6hx-5; 8bis-6; 8bkh-6; 8cra-6; 8dsa-4; 8een-6; 8guh-7; 8kdo-3; 8mah-6; 9pk-3. — ve2cu-5; ve2ee-5; vp5ab-4; vp5az-5.

M. O. Okochi, J2JJ, 17 Yanakashimizucho, Shitaya, Tokio, Japan

(7 mc.)

W 1aja-5; 1ch-6; 1gdy-3; 1gf-5; 1pa-5; 2etm-5; 2exm-4; 3anh-5; 4aue-5; 4vc-4; 5adz-9; 5aqy-6; 5biq-6; 5bkv-7; 5cjv-6; 5esx-8; 8bct-4; 8bti-5; 8cjj-3; 8gd-5; 8hwe-4; 8hzc-5. — cr7ai-5; cr7aj-6; cr7am-4; cx1bu-6; d4bdr-8; d4cem-4; ea1am-4; ea1ap-3; ea3eg-5; fb8ia-6; fb8vx-5; haf3h-3; hb9ae-5; lu1bn-5; lu2ar-5; lu2eg-7; lu4dc-6; lu5bd-5; lu5bl-6; lu6ax-6; ly1j-4; oe1er-6; oe3jz-3; oe3wb-6; oh6nn-5; ok1ff-5; ok1ln-5; ok1va-5; ok2dd-5; ok2rm-5; on4gv-3; on4pa-5; py1aw-4; py1bb-5; py3aj-3; py3bs-4; sp1aq-3; sp1at-4;

[*Continued on Page 59*]

THE ELECTRON COUPLED OSCILLATOR

Theory and Operation of the Dow Circuit

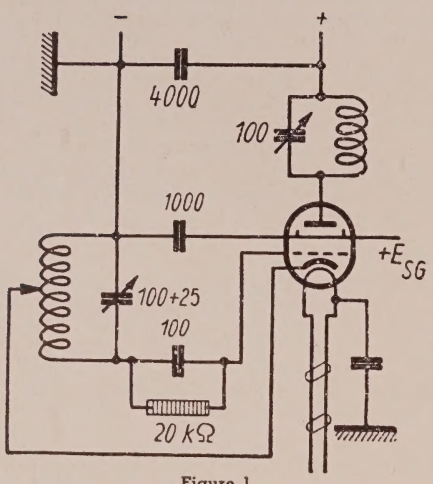


Figure 1
A typical Dow oscillator circuit. The coil and condenser at lower left are L_1 C_1, the frequency-determining element of the oscillator.

Quite a number of non-crystal transmitters have recently gone into services which are exacting as to frequency-stability requirements but find the inflexibility of quartz control a hindrance. These transmitters seem pretty uniformly to be based on the use of a Dow "electron-coupled" oscillator, working under conditions which give it good stability. These conditions interest amateurs because they apply to both frequency meters and transmitters.

Temperature control is of course highly desirable. The oven used must contain the tube and its associated tuned circuits. Ordinarily the oscillator is made large enough to drive a respectable output stage directly, or at most with one buffer stage, which gives a simple circuit. In one commercial form a Dow oscillator using an 860 tube is used to drive a pair of 860 tubes as a push-pull output stage, so that only one type of tube, only two d.c. voltages (plate and screen respectively) and no neutralizing at all are necessary. The relatively large oscillator is stability-insurance, but also calls for a rather large oven, measuring about 3′ x 2½′ x 1′, which is to say 7.5 cubic feet of space. The tube operates with plate and screen voltages of 2000 and 500 respectively, from the same power supply which feeds the amplifier tubes. The thermostat and heater are chosen so as to hold the oven temperature higher than it can become from the tube-loss alone. The oven is of metal with a lining of some sheet insulating material resembling "celotex" wallboard. Heat is being handled in rather large amounts so that very high insulation is neither necessary nor desirable.

The cost of the 860, and the plate voltage required, produce a somewhat costly rig, but in smaller transmitters the amateur may be attracted by such tubes as the 802, RK-23-25, or even the receiving types, which have indirect heaters and are therefore especially adapted to use as Dow oscillators without recourse to filament chokes, such as are required if this type of operation is attempted with filament tubes such as the 865, RK-20, 860, or—861!

The circuit then becomes that of figure 1, which is reproduced from an article by Dr. H. Haufman of D4BPL. This article, appearing in our excellent contemporary *CQ* points out a number of interesting things about Dow oscillators. An abstract of it follows. Those who read German readily are referred to the original article in the June, 1934, issue of *CQ*, published by the "D.A.S.D."*

Proceeding with the abstract:

A Dow oscillator may be dissected into the form of figure 2, in which it is seen to consist of a triode Hartley-type oscillator with a triode amplifier. It differs from a normal oscillator-amplifier combination only in that:

1. The cathode-current of the amplifier passes through a "hot" part of the oscillator circuit.
2. Since two grids are present one must be made "cold", in any case necessary for a screen grid which is to function as such.

*Deutscher Amateur Sende Dienst (German Amateur Transmitting Service), Schweinfurthstr. 78, Berlin-Dahlem, Germany.

Because the plate circuit is not a part of the frequency-determining system there is small tendency toward feedback, which may be still further minimized by tuning the plate circuit to twice the oscillator frequency (operating as an oscillator-doubler).

The shielding required is a chapter in itself. When doubling, shielding is hardly required at all, but it is absolutely necessary when one is amplifying "straight through". Metallic tubes, or those having a "spray-shield", are troublesome because the tube's envelope is "hot" and instead of protecting against feedbacks it has exactly the opposite effect. The tube as a whole must be shielded for this reason. Despite the best of shielding it is very easy to fall into the Huth-Kühn type of oscillation [which we call Armstrong or t.p.t.g.] which provides one additional frequency *lower* than that for which the L_1C_1 circuit is tuned, not to speak of harmonics. Fortunately this frequency is so far from that of the tuned circuit that it is still quite practical to work stably "straight through". Watching the plate meter for dips, and listening in the monitor for a multitude of frequencies (with bad tone) will

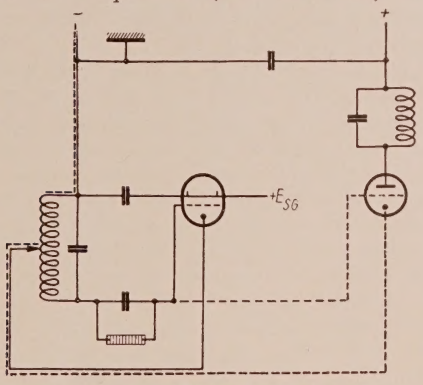


Figure 2
The circuit of figure 1 dissected into a triode oscillator and triode amplifier.

serve to detect the appearance of Huth-Kühn oscillation which is to be avoided.

The proper choice of the cathode tap-point on L_1 is vital in securing proper operation. The oscillator should of course be running with a light load, which would at first seem to suggest that the tap should be near the grid (lower) end of the oscillator coil. However this same grid is unfortunately also the grid of the amplifier section; hence the amplifier section rapidly loses r.f. input when the cathode tap is moved toward the grid. An attempt to increase the output of the plate by running the screen more positive is quite likely to produce secondary emission rather than plate output increase. To illustrate this point Dr. Kaufman ran tests on a small tube which appears to correspond to an under-run 802. Using a 25 turn coil in the oscillator position (lower left in figure 1) the cathode tap was tried at 5, 9, and 14 turns from the screen end of the coil, with the following results:

1. Using 5 screen turns and 19 grid turns the efficiency and output were low. The best output was about 1 watt.
2. Using 9 screen turns and 14 grid turns plate efficiencies up to 55% with output of 1.6 watts was obtained when running at 300 volts plate and 100 screen.
3. Using 14 screen turns and 9 grid turns th maximum output obtainable was only .6 watt, and fell rapidly on either side of the best adjustment.

Running as in paragraph 2 there was no difficulty in driving an output stage which worked at a plate-circuit efficiency of 48% and delivered 11 watts to the load. For an 802, running anywhere near rating, these figures would be increased materially, there being nothing in particular to prevent ample output for driving a pair of 802 tubes in push-pull with a c.w. output of 30 watts. At the present price of 802 tubes a trio of them working non-crystal as outlined, and fed from a "receiving type" power supply present still another simple and good c.w. transmitter.

Reverting to the abstract:

Dr. Kaufman found that it was necessary to ground the filament circuit to chassis to prevent various warbles, though he suggests that it might be satisfactory to do this via a condenser as in figure 1.

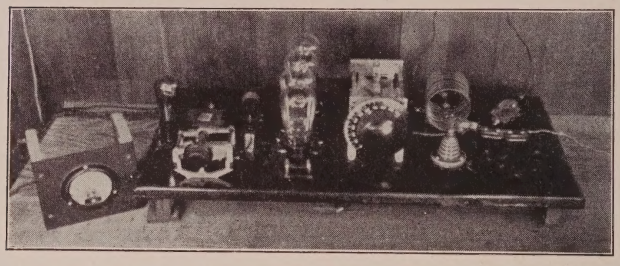
The best frequency stability was found by adjusting the screen voltage or plate voltage, the *ratio* between them being the important thing. The use of gridleak bias makes this adjustment possible without any great complication. For this particular tube a leak of only 20,000 ohms was found best but some testing is suggested.

[*Continued on Page 59*]

HIGH "OVERALL" 7 MC. EFFICIENCY

At Low Cost

By WAYNE COOPER*



Four bottles of 40 meter "soup", 10 watts per bottle

The regular ways of obtaining output powers higher than 8 or 10 watts add a lot of unnecessary complications in the form of buffers, etc. This idea struck before multi-element tubes and high-power crystals. With them the problem was solved—but with added expense.

How to obtain plenty of power output with *ordinary* triodes and crystals, have good stability, clean keying, and a pure tone, was the problem. A self-excited oscillator could be used to give high power but the characteristics of such a transmitter are not up to present standards.

It has been said that the necessary high-C tank of a self-excited transmitter is not desirable because of the low efficiency. While the present set does not have a very high-C tank it is only fair to point out that such a transmitter, if but 40% efficient (output 40% of total input considering both plate and filament) still compares favorably with others, for it is delivering 40% of the *total* input, and that principally on the fundamental because the harmonics are suppressed by the high-C circuit. On the other hand in a "high efficiency" multi-stage transmitter the output is about 50% of the *total* input. But of this output a large part is not at fundamental frequency. This may easily make the 10% difference and leave the multi-stage transmitter below the humble oscillator-only transmitter.

There is, then, something to be said for the simpler transmitters, at least in c.w. transmission.

After trying various circuit arrangements[1] we settled on the one shown in figure 1 as being as satisfactory as any and a great deal cheaper than some. It is a simple push-pull crystal oscillator using 4 of the cheapest tubes and a very low-priced power supply—to turn out 40 good watts in the form of a high-quality signal. The results seem quite pleasing from every standpoint.

The push-pull circuit is made regenerative by the use of a grid coil instead of grid leaks only. Since this tends to create rather too much feedback the condensers C_1 and C_2 are placed in series with the crystal to permit adjusting the r.f. current through the crystal. In the set here only one of these condensers is variable. The other is a fixed air condenser consisting of two pieces of sheet metal 1/4" apart and each 2" square. These are solidly supported to avoid "warbles". It is easiest to place them horizontally and to use the top one as the lower plate of the crystal holder! The crystal lies on its flat-ground upper surface and a light top plate lies on the crystal. This top plate has the size and weight of a 1c piece.

The 99 filament (for a fuse) was put in series with the crystal to protect the crystal

*Box 59, R.F.D. 1, Hope Ave., Santa Barbara, California.

[1]Especially "500 watts from a Crystal Oscillator", *R/9* Nov. 1934, and various articles as to the so-called "R" circuit. (Editor's Note: The "R circuit" is a European resurrection of an American idea as old as crystal control and once fairly popular under the name of "Crystal Stabilized Self Oscillator" or "CSSO circuit".)

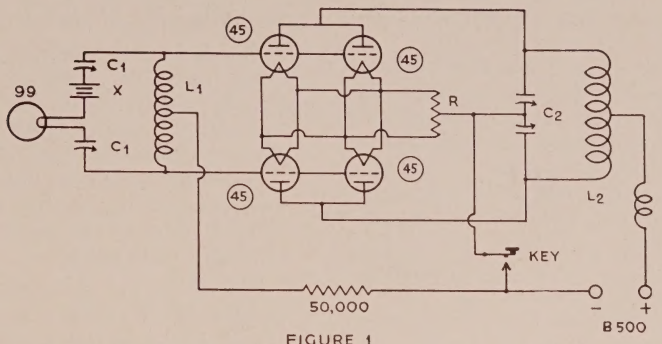


FIGURE 1

The "economy special". It puts out 40 watts of x.p.d.c. signal with the skimpy filter shown in figure 3 when properly tuned. A 1/10 μfd. condenser across the key may cut down clicks, if any.

L_1—20 turns no. 24 wound on 1" tube (close wound). L_2—See text. C_1—0.00005 or 0.0001. C_3—0.00005 midget.

during adjustments and in case the antenna is accidentally off when the key is pressed. This filament is also very helpful when adjusting, as its glow gives an immediate idea of the r.f. current through the crystal. This tube filament is highly recommended, even though an r.f. meter is used to measure the crystal current, because the tube will protect the meter as well as the crystal. By adjusting the series condenser C_1 in the crystal circuit and detuning the plate tank C_2 for correct crystal and plate-input current the setting can be found which gives best tone, keying and general stability. These adjustments are not hard to find by looking at the meters and listening to a monitor.[2] The transmitter used in the experiments has a home-ground "Y" cut 7 mc. crystal in the grid circuit and in the plate circuit there was a coil formerly used in a small "high C" 3.5 mc. non-crystal set. This coil was formed by winding 12 turns of ¼" copper tubing on a 2" pipe. So heavy a coil is not necessary, but it was on hand.

The adjustments of the experimental transmitter were found to hold from day to day and it started off every time with the throw of the switch.

100 Watts In, 40 Out

The 4 type 245 tubes were used in push-pull parallel with 100 watts input (200 ma. at 500 volts). This does not seem to be excessive for the tubes have been used for 2 years at this input.

The output was estimated by using a 40 watt lamp clipped across part of the tank coil L_2, the clips being set to produce the usual 100 watts input. The 40 watt lamp was at about full brilliancy, looking like another one which was burning on the line. This is not accurate, but neither is accuracy important at this point.

Variations

The set can be worked as a non-crystal Armstrong oscillator by shorting the crystal holder. It then is the ordinary "tuned-grid,

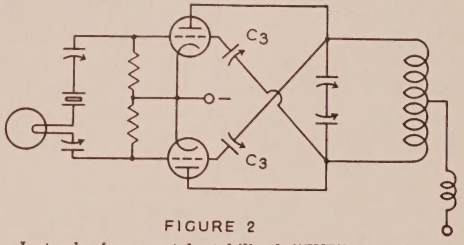


FIGURE 2

Instead of a crystal stabilized "TNT", we have here a Hartley transmitter of the same ilk. It performs much the same as the circuit of figure 1, except that it is more critical as to tuning.

tuned-plate" (Armstrong) circuit. The grid condenser is varied until the plate current is ½ that obtained when the set is loaded with the antenna. For this type of operation the performance will be more stable with less plate coil (6 to 8 turns) and correspondingly more plate-circut condenser. Needless

[2]Meaning a shielded antenna-less c.w. receiver, usually with but 1 tube, used for just this sort of work. The monitor is ordinarily made of a 99 or 30 tube and operated by batteries also placed in the shield. In a transmitter like this one practically everything depends on careful monitoring. —Technical Editor.

to say monitoring is now even more important.

The circuit of figure 2 was also tried. It is a crystal-stabilized Hartley oscillator. Opposite feedbacks arrive at the grid by two routes: (1) through the plate-grid capacity

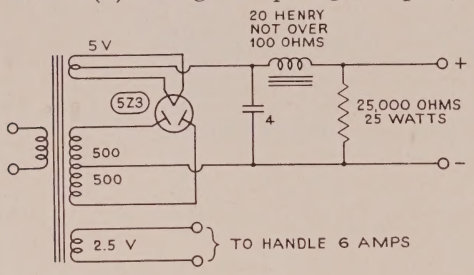


FIGURE 3

Power supply for the transmitter described. The transformer should be at least of 100 watt rating. An 83-v may be used in place of the 5Z3 rectifier.

inside the tube and (2) through the variable condensers C_3. Therefore by setting these condensers one may make the circuit *barely* oscillate without the crystal, L_2C_2 being set to crystal resonance. This is a critical setting, though with a good crystal satisfactory results were obtained.

Power Supply

The power supply should have fairly good voltage regulation to avoid excessive shocks to the crystal when keying. Figure 3 suggests one suitable form. Some transformers do not carry a 2.5 volt winding intended to carry 6 amperes; an independent filament transformer may be needed.

◆

The next Delmarva ("Eastern Shore") hamfest will be held July 13th and 14th at Ocean City, Maryland. Registration will be at the Hotel George Washington, starting at 10 a. m. There will be a dinner and dancing in the evening. The chief events of the next day will be seaplane and speedboat rides and beach games. For tickets (price, $3.00) or further information, write E. L. Hudson, W3BAK, Laurel, Delaware.

◆

Bound Brook, N. J.

Sirs:

Thank you for the February copy of *R/9*. I was led to believe long ago that you represented "The Big Bad Wolf" of the amateur fraternity, the "I.W.W.", the outcast, or what have you. You can easily picture my surprise then to find a magazine of good appearance, good paper, well printed and interesting.

So, if all the future issues are like the sample, you can accept the enclosed check. . . .

J. E. C. Valentin, W3EWV

QUICK CHOKE TESTER

The choke to be tested is used at the position "r.f.c." to supply in *shunt feed,* the d.c. plate supply of the triode oscillator. The "osc. circuit" may be either Hartley or Colpitts with constants chosen to permit tuning through the bands you are interested in without going to very low condenser capacities. A "40 watt" or larger tube is desirable, with rated plate voltage.

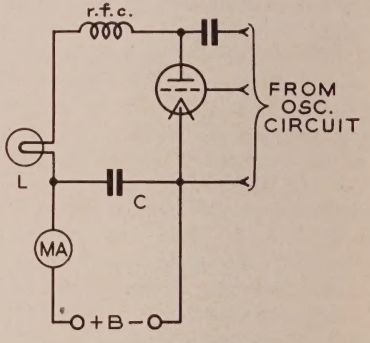
Choose the 110 volt lamp L by test, so as to light red or orange.

Dim the room lights and swing the tuning condenser. With a good choke MA will rise gradually across the tuning range and the lamp will vary in about the same way.

With a fair choke, MA will still rise gradually but the lamp will go bright and dim by turns. If the lamp gets bright in your pet band, try another choke.

A really bad choke will cause both L and MA to swoop and dive.

Make the first test swing of the condenser rather rapidly so as to get a complete mental



picture of the performance of the choke, then hunt down the details.

Another lamp may be used in place of MA.

This scheme checks with various other methods and is both quick and easy.

◆

Atlanta, Ga.

Sirs.

What good would it do if the F.C.C. adopted a regulation making ten minute CQ's a penitentiary offense? You can't read the lid's call when he signs, so what?

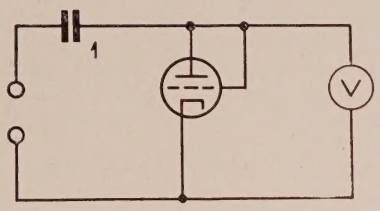
Oh for a chance to caress their necks,
Those low powered W's who answer my "CQ DX"!

B. W. Benning, W4CBY

A UNIVERSAL VOLTMETER

Of Many Uses

By A. W. Parkes, Jr.*



Fundamental circuit of r.f.-a.f. alternating current voltmeter. Just because a triode is shown, do not get the idea that a grid is necessary. A 1-v rectifier will work fine.

An extremely handy voltmeter for alternating current measurements at either audio or radio frequencies may be constructed in a few moments from material at hand in almost any amateur's radio station.

There are required only a (good) one microfarad condenser, a 1000-ohm-per-volt d.c. voltmeter, a 237 (or similar) tube, 4 binding posts and a transformer for heating the tube.

The connections are shown in figure 1 and little explanation is needed. To measure any audio or radio voltage, connect the source of that voltage to the terminals at the left. The 1000-ohms-per-volt meter is shown at V. Make certain that the meter is connected to a high-voltage range if you are not certain as to the magnitude of the voltage to be expected. Then if the meter reads too low, shift to the next lower range.

Figure 2 shows the calibration for the 0-300 volt scale in terms of the a.c. voltage. It happens that a 0-30 range will read approximately the a.c. input volts. It is therefore convenient to add that range to the meter if you do not already have it.

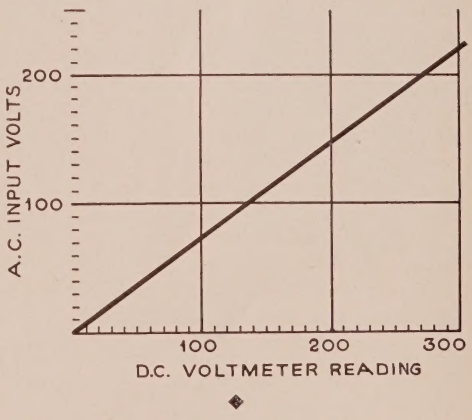
Uses

The instrument should be a very useful amateur instrument for indicating audio output (voltage across a known load gives watts), audio voltage levels of amplifiers, modulators, etc., and also the r.f. voltage across tuned circuits in transmitters. Of course it is more complicated than a neon lamp, or a 10c lamp bulb, but it is more exact in indicating resonance when lightly coupled to appropriate parts of the circuit. It is especially useful during neutralizing (balancing) adjustments.

The load resistance of this unit will, of course, vary with the scale used, and for the 0-3 volt scale will be 3000 ohms, and for the 0-600 volt scale will be 600,000 ohms. This is not as high as the biased triode type of vacuum tube voltmeater, which may be in the megohms, but its simplicity recommends it for use where this loading is unimportant.

The instrument is essentially linear.

The operator owning a 0-200 microampere d.c. meter (5000 ohms per volt), would of course be in a better position than the one using the 0-1 meter (1000 ohms per volt) discussed above. The 0-200 microampere meter may be used with a series resistor of approximately 1,260,000 ohms to secure a direct reading voltmeter with a high input resistance.

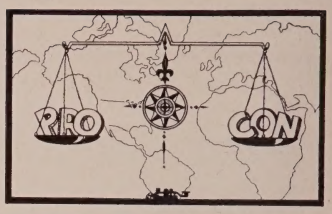


◆

We've heard several eastern stations using 203A Class B audio tubes with a 5 k.w. pole transformer as an output device. They were better than average. The circuit depends on the available windings. An autotransformer connection is one possibility, the voltage-adjusting taps providing some step-up turns.

*47 Cobb Road, Mountain Lakes, New Jersey.

THE OPEN FORUM



Vandalia, Ohio

Sirs:

Let's get the amateurs to give congress some thoughts on more frequencies. Outline in the next issue of *R/9* what you want each amateur to say in his letter or card to Washington, and flood that place full of appeals for more frequencies. . .

(This) will tell where *R/9* will stand for now and forever.

LOYAL BETTELON

Few things are more futile than stereotyped or form letters in Washington; they are too readily recognized for what they are. There's little use in an amateur's writing his congressman or senator if he hasn't sufficient interest in more frequencies to compose his own letter.—EDITOR

◆

Santa Maria, Calif.

Sirs:

Will you please do me a favor by abandoning the use of those scenic covers you have been using on *R/9* of late?

The only way I can tell what issue I have in my hands is to turn to the title page of each copy I pick up, which is very inconvenient and a waste of time.

Oh, yes: My wife cuts the covers off of each *R/9* that sports a pictorial front end.

You might run off a few extras each month on paper suitable for framing and sell them for ten cents or so. Then I wouldn't object to your running them on the cover; I could keep my copies intact.

Incidentally, I know of at least one instance where an *R/9* was purchased merely for its cover; the purchaser had no interest whatever in amateur (citizen) radio.

CLIFFORD BOARDMAN, W6ASK

◆

Galveston, Texas

Sirs:

. . . amend the A.R.R.L. Constitution or By-Laws in a manner that would set the maximum salary for any official of the A.R.R.L. to the maximum amount of $300 monthly. $3600 per year.

Eliminate all present members who do not hold an amateur license. This should not prevent yearly subscriptions to *QST*. Members now in the A.R.R.L. without an amateur license would be dropped as their present subscriptions expire.

. . . in other words, anyone should be able to subscribe to *QST*, but only amateurs with a license could be members of the A.R.R.L.

Move A.R.R.L. headquarters to the central part of the United States. This can be accomplished easily with the money saved as above.

Let's have the A.R.R.L. make a real attempt to secure more frequencies for us instead of setting back and making all sorts of excuses why it can't be done. . . .

C. A. MURGATROYD, W5BUV

◆

Chicago, Ill.

Sirs:

I have seen many letters written about the RST system, both for and against it. The letter by W3QP published in April *R/9* is by far the best I have read. I agree with W3QP 100%.

Let's just forget there ever was an RST system.

R. W. MCCARTY, W9KA

◆

Duarte, Calif.

Sirs:

Full responsibility for the month-by-month operation as well as the general policies of the A.R.R.L. should be borne by its board of directors. While I doubt the plea that more than one meeting yearly is financially not feasible, there is no reason why correspondence cannot be supplemented by frequent gatherings of a directors' committee.

I propose that the so-called Executive Committee be overhauled to make it a committee of *directors* instead of *officers*. At present, it comprises the president, vice president, secretary, treasurer, and communications manager. The first two officers are directors, and, while the latter three sometimes seem to be *ex-officio* both, they are

[*Continued on Page 60*]

WHEN THE "R. I." PAYS A VISIT

Once upon a midnight dreary, when of something
I was weary,
I had drunk a pint of whiskey, and was wishing
for some more;
When suddenly there came a tapping, sounded
like someone rapping—
Rapping like the very devil, just outside my
hamshack door.
'Tis someone thought I, who was wishin', to my
shack to gain admission,
Well, I'll rise and let him enter, even though
he be a bore,
Even this and nothing more.

So I opened wide the portal, and there before me
stood a mortal,
Who in all my long career I had seen but once
before;
'Twas the R. I. himself in person, and I could
guess the reason
For his little visitation, as I went to close the
door.
Even this and nothing more.

'Twas a night without a sleeping, and with sad
regrets and weeping,
I thought of all the things that I had done
before,
'Twas the fourteenth of November, but more
clearly I remember—
What it was that did confront me on November
twenty-four,
Sequel of ten days before.

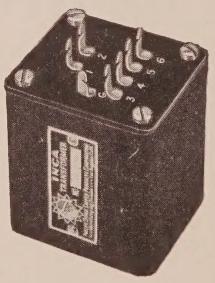
I was charged with off-band operation, and an
outfit obsolete,
No way of measuring frequency, no log-book
nice and neat,
My filter system wasn't there, my sigs were awful
on the air,
Broad and shaky said the letter—and I knew
my day was done.

Now my shack stands closed and locked, boys,
my haming days are o'er,
No more will you cuss my signals—you fellows
right next door.
The BCL's will live in peace, the air'll be nice
and quiet
For my CQ's won't hog the air for nigh on half
the night.
And I swear these vows forgotten, as I think of
my signals rotten
Not for uncle, not for damnsight, like the
raven—nevermore.

—Wymar, N6ADB, in *Listening In*

Announcing . . .

THE INCA "TA" AND "TS" SERIES



A group of audio transformers, miniature in size but great in performance. Designed to fill the increasing need for wide-range portable equipment, these transformers permit a frequency range of from 30 to 12,000 cycles in a case only a fraction of the size previously necessary to attain these characteristics.

These units, originally developed for special applications in the Hollywood recording studios, have met with such immediate acceptance and such a large demand has developed that we have decided to make the units generally available.

The new INCA Bulletin L-9, giving complete specification and mounting data, may be had from your jobber or by writing direct to:

The Phelps Dodge Copper Products Corporation

INCA MANUFACTURING DIVISION

2375 East 27th Street - Los Angeles, California

INCA

Directive Antenna

[*Continued from Page 9*]

"Zepp." Feeders

To check the length of the antenna on a "zepp." system, take down the antenna and hoist the feeders back up. If any change in tuning is necessary to resonate the feeders alone, the antenna was not of the right length for the frequency used.

[EDITOR'S NOTE: The method is sound and direct. There is some doubt as to the importance of a precise "zepp." antenna length as long as the system *as a whole* is resonant. See leading article in *R/9* for May.—R. S. K.]

◆

New York, N. Y.

Sirs:

. . . Like your rag. Sure is swell, and get Perrine to write plenty on high power.

RAY FARWELL, W2BJ

◆

Palmyra, Penn.

Sirs:

. . . and also allow me to congratulate you on the fine magazine that you are putting out. It certainly is one of the best that I have read yet and I get four and sometimes five every month.

R. A. GARLIN, W3BCZ

MERGED!

LISTENING IN

AND

THE HAM REPORTER

have been merged into one big, newsy magazine. Devoted exclusively to the personal activities of amateur radio operators of the entire west coast. A most necessary supplement to your pet technical magazine.

◆

Place your subscription

NOW!

P. O. Box 723 **Corcoran, Calif.**

Break-in Keying

[*Continued from Page 24*]

will radiate sufficient r.f. to cause distinct clicks in b.c. sets.

The cut-off voltage should be quite high (200 volts or over). This resistor is necessary to prevent the key from completely shorting the bias supply.

The current drain is so small that almost any source of supply will be satisfactory. A light cheap receiving type power transformer would furnish the whole thing, including filaments for 45's, for the 80 bias rectifier, and for the high voltage itself. With this arrangement the signals are clear cut. Clicks can hardly be heard in a b.c. set with gain clear on (no station tuned in). An R2 or R3 signal will break-in easily unless QRM is too bad.

◆

MODULATION NOTES

[*Continued from Page 33*]

larly noticeable on the 20 meter band, because degree of frequency modulation goes up in direct proportion to frequency. In other words, frequency modulation is just 8 times as bad at 20 meters as it is at 160 meters. This can be seen easily from the fact that if we shift the frequency of a 160 meter oscillator 1 kilocycle, the 20 meter harmonic has shifted 8 kilocycles.

Now we all know that a crystal is vastly superior to a self-excited oscillator from the standpoint of frequency change with change in plate voltage. But even a crystal oscillator is not entirely immune. A 5% change in plate voltage will cause a perceptible change in the frequency of a 160 meter crystal, and a quite noticeable change in frequency at 20 meters.

Suppose that our varying load on the line, caused by the surging plate current to the class B modulators, results in such a variation in line voltage. Someone turns a beat-oscillator on our 20 meter phone signals and notices that we have "frequency modulation". A careful check will reveal that the

DID YOU KNOW?

That in addition to sensational "Specials" Harrison carries one of the largest stocks of standard Ham gear? Complete stock at all times of Cardwell, Hammarlund, RCA, Leichner, Johnson, etc. The Amateur may send his order at any time to Harrison with confidence. He knows that his order will be filled exactly as he specifies and shipped the same day. He knows that he is paying the lowest price in the country. See advertisements on pages 55 and 57.

carrier *frequency* is not being modulated at *audio* frequency, but rather is being *syllabic* modulated. 17 buffer stages will not help this type of frequency wobbulation. What is needed is either better line voltage regulation or a modulator *whose plate current does not kick so much.* This can be realized by a pair of class A prime tubes, but less audio is available from tubes of the same dissipation rating.

The New 838

This is a rather long-winded introduction for a well-deserved plug for the new 838 tube, but now that we are through with the preliminaries it should be sufficient to state that a pair of 838's will turn out as much audio as a pair of 203-A's in class B, will do it with very low distortion, and with much less drastic demands on the plate supply regulation; the "resting current" for a pair of 838's at 1250 volts is about 150 ma. as compared to 25 or so for a pair of 203-A's in class B (both types kicking up to nearly the same plate current on maximum signal peaks).

28 Megacycles

W8IXS complains of QRM on 10 meters! W2TP puts in a beautiful phone signal on the west coast. W4MR has been heard by VK2EP. W9NY has been poking a nice signal into VK. W9FM ties the plates together on his push pull 852 20-meter rig and puts out plenty of watts on 10 meters merely by sticking in a 10 meter plate coil for the 52's. Loudest and most consistent 10 meter signals seem to be getting their start either from a vertical "double zepp." (two half waves fed in phase) or a long, high-harmonic horizontal.—W9FM.

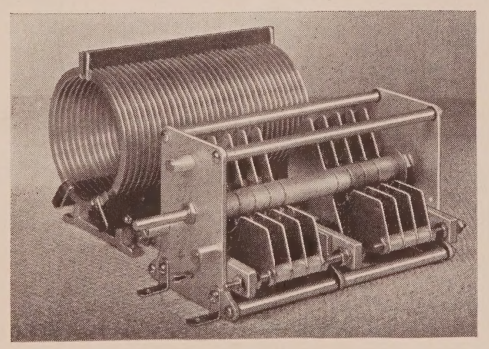
◆

The Milwaukee *Journal* station W9XAZ is now working on 31.6 mc. with 500 watts in the final amplifier. Each Saturday an hour and a half program is conducted over this station by the Kilocycle Club of Milwaukee which is anxious to obtain reports on the reception of these broadcasts as well as comments on their interest to amateurs. Address: H. Charles Kaetel, Chairman, Program Committee, 2851 N. 25th St., Milwaukee, Wisc.

THE *PERFECT* COMBINATION!

Here is the perfect combination to insure highest efficiency and simplified construction in your 1935 Transmitter . . . **Johnson Matched Tank Circuit Components!**

Gone are the days of troublesome inductance-capacity calculations and laborious cut-and-try coil construction. Now you simply consult an easily-understood table, and order the proper Johnson **"Hi-Q" Inductor** and **Type "D" Condenser** for your operating bands. That's all there is to it . . . And you get commercial-type components with peak-efficiency performance at no more than the cost of less-effective substitutes. **They're ideal for the new Band-Switching Circuits, too!**



Bulletins 2009 and 3509 will enable you to quickly select the proper Johnson Matched Tank Components for **your** transmitter. Any Authorized Johnson Distributor will gladly supply this data, or you may write us direct.

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E. F. JOHNSON COMPANY

Manufacturers of Radio Transmitting Equipmen

WASECA, MINNESOTA, U. S. A.

WITH THE EDITOR

[*Continued from Page 6*]

business depression was in all probability very small compared to that which may be expected at Cairo.

Southwestern Division

The creation of a Southwestern Division, long ardently advocated by some groups in the southern portion of the Pacific Division, was voted by the Board 14 to 1*. The justification for this splitting up of the Pacific Division in our opinion will come, if at all, not so much in the matter of area or population as in the character of the Director whom it elects.

Committees

A "Cairo Committee" consisting of Atlantic's Woodruff, New England's Bailey, and Central's Roberts was appointed to examine the question of securing more "privileges" for citizen radio at Cairo. With its object all amateurs will be in accord. The effectiveness of such a committee will, of course, depend upon its personnel; the members selected we feel constitute an unfortunate choice. We have no doubts of their wish to be successful. But we are convinced that only a very progressive, aggressive campaign stands any chance at all of success. Two of these directors have by their votes stood behind the League's administration in its hitherto unaggressive attitude, while the other has consistently praised that administration in his writings.†

*Opponent: Atlantic's Woodruff.

More QSL Bureaux

The Board meeting also approved a motion that additional A.R.R.L. QSL Bureaux shall be established in U. S. possessions so that each A.R.R.L. district having its own prefix shall have a QSL Bureau. In other words, the Communications Manager was ordered to find several more self-sacrificing amateurs willing to put in long hours and hard work in the service of their fellow hams with no remuneration whatever while fancy salaries are being paid elsewhere. It has never been clear to our obtuse intellects why all League salary expenditures must be made in Hartford, why services rendered elsewhere must be uncompensated, that is, no *legitimate* reason why this should be so has occurred to us.

Hoodwinking

The hoodwinking continues. The A.R.R.L. is an amateur organization, we hear it said over and over. Doesn't this statement jibe ill with the action of the Board in turning down the suggestion of the two consistently progressive directors that every prospective League member must file an application giving data as to the class of license held, its expiration date, and the call letters assigned, if any? We know of no other organization of its class in which a detailed application is not required. Fear of a loss in revenue from such "drastic" action has been cited as a reason. Probably this fear is 99% groundless. And even if it were partially true, what of it if the League is a non-profit organization as it is regularly claimed to be?

◆

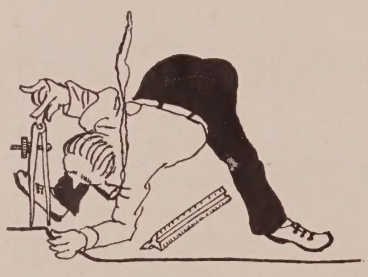
Fort Howard, Maryland

Sirs:

. . . I have seen your magazine grow from a pamphlet of only a few pages to a magazine which is very nearly on a par with the best. . . .

SGT. ELMER S. LESHER

†As we go to press fragmentary reports of a late speech by this director appear to indicate a change of viewpoint on his part.



Just Wasted Care

—unless it's sturdy
No. 12 Enameled
"COPPERWELD"
"Doesn't stretch out of tune."

◆

Write for latest prices

M. E. CARTER
North Branford, Connecticut

How High Is "Up"?

The way to get out of noise for reception is to go up, and the way to get out of screening and absorption for sending is also to go up. Here are some illustrations:

At a certain radio factory a horizontal receiving doublet gave pretty poor results when hung between the cornices of two adjacent factory bays. The noise was gosh-awful. The thing was 80 feet off the ground but swiveling it hither and yonder did no good; even in a screened room the receiver was all full of noise. Then an old-line radio man who remembered that we used to use poles that went a little higher than the blue grass stuck two 30 foot poles upon the the roof and the noise dropped about 95%. Not, mind you, because the height above ground was raised from 80 to 110 feet, which after all is only about 37% increase. It was because the distance above the wiring was increased from about 5 feet to about 35 feet, which is an increase of 600%.

Again, a sending station in Kansas got out very poorly with an antenna hung from the maple trees. The trees were 65 feet high and the antenna consequently about 50 feet up above Kansas—but 15 feet *down* among the trees. Two poles were put up, 70 footers. There was no guying space for higher ones, alas. Experiment showed that the range was about the same with the antenna at 30, 40, 50 and 55 feet up—but jumped enormously when the antenna was sent clear up, which of course meant only about 65 feet on 70 foot poles. The antenna height above Kansas had been increased from 50 to 65 feet, about 30%. The height-

Warm Weather hasn't slowed down the demand for...

KRUSE'S
RADIOPHONE GUIDE

FOLKS KEEP RIGHT ON IMPROVING THEIR RADIOPHONES—
so of course they send us letters which contain 50c and say "I want a guide".

●

The address is still

Kruse's Radiophone Guide
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- HIGH D.C. OUTPUT.
- TREMENDOUS CURRENT CAPACITY.
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RATINGS—15000 V. Max. Inverse Peak.
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100 Watt Keep Alive

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2C—Full Wave	$17.50
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6P—Six Phase	30.00
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advantage of the trees had been cut down from 15 feet to 0 feet, which is something like 10000000% as nearly as you can figure on a slide rule. Anyway the fairly consistent 80 meter range increased from 10 miles in daylight to 180, which is an increase of 1700%. Now if the boss of the works can only figure out how to make those poles go up to 90 or 100 feet without getting into an argument with either dad or the neighbors!

Still once more: Two stations in a certain Connecticut town have been outstanding in the history of that town for the ranges attained with good consistency—and who cares about once-in-a-while ranges? One of these stations had a single 202 tube (an old one at that), but the antenna went almost vertically to the top of a 13-story building. The thing worked on the umpth harmonic. Nobody ever bothered to figure out what the length was, or which harmonic was used. What difference did it make when you could work anyone that could be heard? The other station stood in a place that had a yard about 25 feet square. By defying the laws of physics an 85 foot mast was stuck up—yes, this was in the days of antennas 45 feet high. By test every single 10-foot rise above 25 feet gave an increase in the *consistent* range, though the freak ranges remained about the same. The antenna was sent up by stages several times, dozens of observers were used, and none were told what was going on.

The old-fashioned idea that a radio station needs poles or masts is still a mighty good one—and what a lot cheaper than a kilowatt!—TECHNICAL EDITOR.

CONTRIBUTIONS

Contributions to the article pages of "R/9" are always welcome; technical and constructional material (except mere notes) is paid for upon publication. The rates are not high, but we believe it unfair to solicit material for which nothing is given but a "thank you".

Articles, or outlines of proposed articles, should be sent to Robert S. Kruse, Technical Editor of "R/9", Guilford, Conn. All manuscripts and correspondence concerning them are considered as promptly as permitted by the exigencies of our publication schedule and the pressure of other work. The contributor of acceptable material will be advised of its acceptance; unacceptable material will be returned in good order if accompanied by the usual stamped, addressed envelope.

No limitation is placed upon the type of article which may be submitted. Almost any story gains greatly from good photographs; instructions have been prepared which will enable the layman with an ordinary camera to make them; see the February, 1935 issue or send a 3c stamp for a reprint. Diagrams may be drawn in pencil, and will be redrawn by our draftsman. Please do not ask for a list of subjects on which material is wanted. Write on the subjects you know best, or on those for which you have some new or original ideas or data.

Material which is not technical or constructional in nature should be sent to Los Angeles direct, not to Guilford.

◆

Radio in Marine Rescue

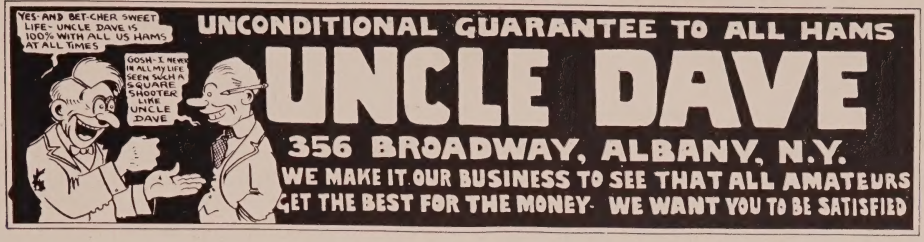
How help was directed to the fishing trawler *Plymouth,* is a story of unusual telephone service involving two Coast Guard boats, the Marshfield marine radio telephone station and the marine position of the Boston toll board, described in detail in *Telephone Topics* of the New England Telephone Company.

On the trawler, disabled on January ninth 250 miles east of Boston Light, was a Western Electric radio telephone with its associated radio direction finder; the latter newly installed and as yet unadjusted and unfamiliar to those aboard. On the U.S.C.G. *Mojave* cruising near shore was radio telegraph equipment. But no direct communication was practicable between these two boats.

The Coast Guard patrol boat *Faunce,* off the Maine Coast, in addition to her radio telegraph was equipped with radio telephone service through the shore station at Marshfield and thus could act as a relay between the *Plymouth* and *Mojave* or between the Marshfield station and the *Mojave.* The problem was to give the *Mojave* sufficient information as to its radio bearing from the *Plymouth,* to enable them to direct their course through 200 miles of fog, to the spot, then only approximately known, where the fishing boat was drifting.

The prime necessity was for a means of determining the bearing of the trawler, so that the *Mojave* might direct her course to come alongside the *Plymouth* with practically no visibility. Someone on the trawler had to be taught how to operate the radio compass sufficiently well to enable someone at the Marshfield station to interpret the observation recorded.

[*Continued on next text page*]


YES-AND BET-CHER SWEET LIFE-UNCLE DAVE IS 100% WITH ALL US HAMS AT ALL TIMES
GOSH-I NEVER IN ALL MY LIFE SEEN SUCH A SQUARE SHOOTER LIKE UNCLE DAVE
UNCONDITIONAL GUARANTEE TO ALL HAMS
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PEERLESS Crystal Ovens . . . Absolutely safe and positive. Black crystalline finished box . . . Accurate bent thermometer on front . . . Complete with crystal in 80 or 160 meter band, net **$8.25**
PEERLESS 40-Meter Crystal . . . Complete with special holder, net prepaid **$4.95**
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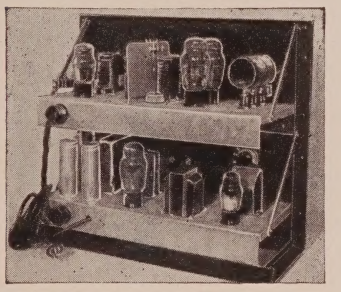
PEERLESS 80 and 160 Meter A-cut Crystals . . . Completely mounted **$5.00**

PEERLESS FILAMENT TRANSFORMERS

	Cased	Uncased
7½ v. 3 a; 5 v. 3 a; 2½ v. 6 a	$2.75	$1.75
5 v. 3 a; 2½ v. 5 a; 2½ v. 5 a	2.50	1.45
Three 5 volt windings 3a. each, 5000 volt insulation	2.75	1.75
2½ v. 10 a; 10,000 v. insulation	2.50	1.25

PEERLESS 5-Meter Transceiver Kit . . . Uses 2-19 and 1-30 tube, as per June 1934 QST . . . Complete kit less tubes, phones or mike, net **$10.33**

PEERLESS "40 DX" TRANSMITTER . . . A crystal controlled transmitter for Phone or C.W. operation. The tube complement is as follows: 2A5 oscillator, 2-46's power amplifier, 83 rectifier, 56 speech amplifier. The west coast is worked on 80 meters with this job on C.W. from Albany and often distances up to 1,000 miles are worked on the same band on phone. Here are a few of its features in concise form.



***Standard Rack mounted
***35 to 40 watts output on C.W.
***10 watts output on phone
***Crystal ground to your specified frequency
***Full output on 2 bands with 1 crystal
***2A5 Dow or Tritet oscillator
***Link coupling
***Standard relay rack bakelite panels
***Burnished aluminum chassis
***Weston milliammeter
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This transmitter comes complete with "ALL" accessories, including crystal, coils for 2 bands, tubes, microphone, and in fact, everything but key and antenna.
Transmitter for combination Phone CW **$63.50**
Transmitter for CW only **52.00**

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Twisted pair wire, made especially for doublet antennas, per 100 feet $1.75
New Jewell pattern 135 2" meters, 0-10, 15, 200, 250, 300, 500 milliameters, EXTRA SPECIAL, each 3.00
New Jewell 3" pattern 74 AC voltmeters, 0-5, 10, 15 volts, each 4.85
New WESTON 2-range milliameters, bakelite cased 301 type, 0-125 ma; 2.5 amperes, net 3.65
WESTON milliameters, 5 ma to 1 amp, net $2.95; in bakelite cases 3.50

Turner Crystal Microphones **$13.25**
5 mfd, 1500 volt working filter condensers, oil impregnated, special **3.75**
Peerless Learn-o-Graph, code learning instrument similar to the teleplex. Brand new, complete with 3 rolls of tape and buzzer, net **13.95**
Baldwin type C headphones, while they last **2.50**
2" pointer knobs and graduated scales, large numbers, neat appearing **.29**
U.S. Signal corps flame-proof keys **.95**

PEERLESS Tubes

10	$1.35	59	$ .68
83	.50	46	.55

Triad tubes, 6B5 and 2B6, net each **1.35**
Franklin class B transformers. Input and output for 46's, per pair **4.25**
Mac-Key, the Professional versatile speed bug **7.95**
Marco illuminated vernier dials . . . No backlash, large scale, special, 3 for **1.00**

WANTED—USED TELEPLEXES!

Dual 350 Mmfd. condensers, FB for receiver or low powered transmitter **$ .69**
Dongan power transformers 1000 volt CT; 2½ v. 3 a; 7½ v. 3 a; 2-25 volt 1 a windings, special **1.85**
IN STOCK! Skyrider, HRO, Browning receiver kit with Tube Tuner, All Star Sr. and Jr. kits.

Dealers! Write for information on the new complete line of Peerless public address amplifiers for all applications.

Amateurs! Write for information on portable receivers and transceivers. All types made to order. Let's hear from you!

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ALL EXPENSE

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Take one of these Tours

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Ride High — pay low — on the roof of the world! Snowy mountains — fine hotels — mile-high golf — swimming, in sight of glaciers — horses to ride — cowboy guides, royal "Mounties" . . . Everybody from everywhere, celebrities and grand old pals, to dine, dance and chum with—at baronial Banff Springs Hotel, Chateau Lake Louise, Emerald Lake Chalet. And you motor along the most awe-inspiring sky line on the Continent!

6 Wonderful Days —
With 2 days at Banff Springs Hotel; 2 days at Chateau Lake Louise: 1 day optional Banff or Lake Louise; 1 day Emerald Lake Chalet. Tour of Banff. Side trip Moraine Lake. All-Expense, *including 126 miles of motoring.* **$70**

4 Colorful Days —
With 2 days at Banff Springs Hotel; 2 days at Chateau Lake Louise; Side trip to Moraine Lake. Visit at Emerald Lake with lunch at Emerald Lake Chalet. All-Expense, *including 126 miles of motoring.* **$55**

Tours begin June 21 at Banff or Field. Each includes motor tour, hotels, meals, rooms, motor transport. Purchasers of these tours may extend stop-overs at hotels on a minimum rate for room and meals, by applying to management where stop-over is desired. Add Rail Fare from starting point. Banff Springs Hotel open June 16 to Sept. 10; Chateau Lake Louise — June 21 to Sept. 10. Include an All-Expense Tour on your way to North Pacific Coast, California, Alaska.

Reduced Summer Round Trip Fares (good return—Oct. 31).
Also Short-Limit Round Trip Rail Fares.

Canadian Pacific Hotels

Apply Local Tourist Agents or any Canadian Pacific Office, or write Manager, Banff Springs Hotel, Banff, Alberta.

[*Continued from last text page*]

H. B. Coxhead and G. M. Hafner were at Marshfield and it was quite obvious to Mr. Coxhead that sufficient instructions could be given to the *Plymouth's* engineer to enable him to take bearings on radio signals, as transmitted from the *Mojave.*

A few minutes before four o'clock, Mr. Coxhead talked with the engineer on the *Plymouth,* and instructed him as to the operation of the radio compass and he was able to get an approximate bearing during the four o'clock schedule. The engineer was instructed to read the radio loop scale and telephone this information to the Marshfield station, together with the reading of the magnetic compass. A few minutes of practice and further suggestions from Mr. Coxhead resulted in good bearings on the remaining schedule that had been set up. Mr. Coxhead, after determining these bearings, would transmit them by radio telephone to the *Faunce* where they were relayed to the *Mojave* by radio telegraph.

Observations were made at six o'clock, hourly from eight until eleven, half-hourly until twelve, quarter-hourly until two and more frequently until 2:35 A.M. when the *Plymouth* reported "*Mojave* is now alongside."

◆

Albany Hamfest

The Albany Amateur Radio Association will hold a hamfest at the Albany Y.M.C.A. on June 29th. Price: $1.25.

◆

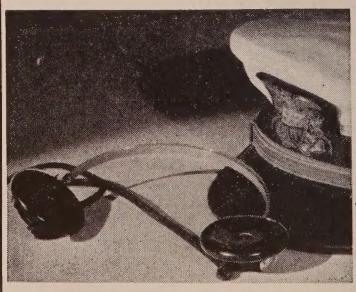
Chicago, Illinois

Sirs:

. . . More power to *R/9* and the west coast gang. *R/9* and *Radio* are two of the meatiest ham magazines on the market. . . .

J. H. Lewis, Jr., W9IN

TRIMM *FEATHERWEIGHT*
The Professional's Headset!



. . . The Special Trimm Featherweight headset is built to be the BEST.

Four ounces on your head is the total weight of this most efficient of all headsets! Write Dept. R96 for catalog.

TRIMM
RADIO MFG. CO.
1528 Armitage Av.
Chicago, U.S.A.

PAYING THE PIPER

In Australia, by special permit, amateurs are allowed to use the broadcast band for their experimental transmissions in the early morning hours and late at night.

We read in the *Bulletin* (Sydney) that these transmissions are much appreciated by many listeners, and that they usually follow regular broadcast transmissions. The material transmitted consists largely of recorded items, usually without reference to their trade names or even to the names of the artists.

Certain of the phonograph companies have decided that amateurs are to use their records scot-free no longer, even though there are no commercial features involved whatever in their broadcasts. This ultimatum is, we understand, to apply both to the higher frequencies and to the broadcast band.

Thus does another "racket" start against the long suffering amateur, another instance of commercial attempts to exploit citizen radio, the only class which, in any country today, represents the right of the general public to the use of a share of its own ether.

And this one seems to have even less justification than some others, for it is doubtful if it will bring an extra pound of revenue into the phonograph companies' coffers, for no amateur would be justified in paying fees for the right to use recorded material in an experimental transmission from which he will never receive any revenue, direct or indirect.

And once again the general radio public is robbed of a service from those who operate purely for the love of it—robbed for the purpose of lining the pockets of those whose only interest in the public's ether is how much they can make out of it.

Though U.S.A. amateurs are not allowed to use the broadcast band, and are limited in the broadcasting of entertainment material, it is not unlikely that we, too, will soon be subjected to the same "racket" if the Australian companies should succeed in obtaining any revenue from their newest "gag".

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To clear out our excess back copy stock, we offer

12 DIFFERENT BACK COPIES of *R/9*, postpaid, for just $1.00

(U.S.A. ONLY)

selected AT RANDOM from issues of September, 1932, to October, 1934, inclusive.

No requests for particular issues filled at this rate.

"R/9"

7460 Beverly Boulevard Los Angeles, California

Ten thousand lids come on the air
And test and test and test;
Should one desist, and try his first,
He's jammed by all the rest.

He wonders why there's no reply,
And then, as you have guessed,
The blankety blank* will throw the switch
And test, and test, *and* test.

—W1FK.

*Optional

◆

Minonk, Ill.

Sirs:

. . . My *R/9* came yesterday. Last night I read it from cover to cover, and I am very well satisfied with the magazine. . . .

Your boys are doing a wonderful job and I am sure that the amateurs in general sooner or later are going to be behind you.

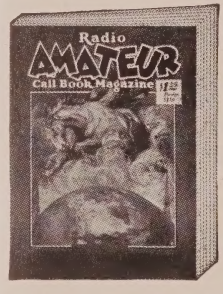
GEORGE T. SPERRY, W9CBJ

MAXIMUM CURRENT RATINGS OF STANDARD RESISTORS

(Courtesy, Aerovox Corp.)

Resist. Ohms	10 Watt	10 Watt	50 Watt	75 Watt
1	3.16 amp.			
2	2.24			
2.5	2.00			
3	1.83			
5	1.41			
10	1.00			
20	707 ma.			
25	634			
30	578			
50	448			
100	316	500 ma.	707 ma.	877 ma.
200	224	354	500	613
300	183	292	408	500
400	158	250	354	432
500	141	224	316	388
750	115	183	258	316
800	112	177	250	306
850	108	172	242	297
1,000	100	158	224	274
1,500	82	129	183	224
2,000	70.7	112	158	193
2,500	63.4	100	141	172
3,000	57.8	91.2	129	158
4,000	50.0	79.2	112	137
5,000	44.8	70.7	100	122
6,000	40.8	64.5	91.2	112
7,000	37.8	59.8	84.6	104
7,500	36.6	58.8	81.7	100
8,000	35.4	56.0	79.2	97.0
10,000	31.6	50.0	70.7	87.7
12,000		45.7	62.0	79.2
15,000		40.8	57.8	70.7
20,000		35.4	50.0	61.3
25,000		31.6	44.8	54.8
30,000			40.8	50.0
40,000			35.4	43.4
50,000			31.6	38.8
60,000				35.4
75,000				31.6

These currents should not be exceeded in *any* portion of a voltage divider.



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Apparatus and station designs and improvements.
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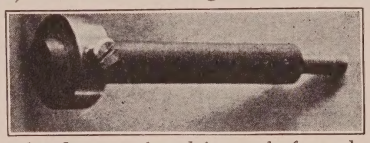
—**For the Amateur:**
High-grade discontinued commercial transmitting equipment.
"The Answer Factory," a low-cost information service on operating and constructional problems.
Quotations on request.

ROBERT S. KRUSE
GUILFORD, CONNECTICUT
(Near New Haven)

SHAFT COUPLING

This has been on our minds for years. In our estimation, which may not be important, there isn't an insulating shaft coupling available to amateurs which is anywhere near substantial enough. Just to show we know the manufacturing business better than the manufacturers we've made up an insulating coupling as we like it. The alleged merits of this coupling are as follows. First and most important, the set screw is an honest to goodness No. 10 and it goes through an honest quarter inch of collar thickness. You can jam it down hard without any danger whatever of stripping and it stays put from thence forward. Similarly the shaft end is pinned twice and by experiment it is possible to twist the shaft off before it turns in the insulating member. This insulating member is long enough to give some insulation (3¾") and incidentally to keep the capacity down. This is not a flexible coupling but no difficulty has been found in lining it up to run properly. This isn't because it is a sloppy job but because it is a good job. The insulating member is reamed



through, fits on the driven shaft and runs true with it. If dials can be put directly on condensers can't they be put on a true running extension? The answer is that they can and they don't need an outboard bearing as with a flexible coupling.

◆

Sirs: Fairfax, Calif.

One look at that new, bigger, and better *R/9* and I decided I coulnd't do without it. It really is a fb. mag. and I think it is the best in the field. . . . WALTER H. SMITH, W6JMR

It Surely Pays to Buy at HARRISON'S

Same Day Shipment of Your Order — From Our Enormous Amateur Stock

G. E. Pyranol Transmitter Capacitors

2 Mfd. 1000	$2.65	1 Mfd. 2000	$3.09
4 Mfd. 1000	4.12	2 Mfd. 2000	4.70
1 Mfd. 1500	2.20	1 Mfd. 2500	8.24
2 Mfd. 1500	3.67	1 Mfd. 3000	10.58

R.F. CHOKES—Type 100 pigtail, 4 pies, 2½ Mh., 125 ma..... **5 for 50c**

Aerovox Molded Mica Condensers—Type No. 1450

.01 **27c** each or 4 for..... $1.00
.0002 **10c** each or 6 for..... 40c
.00025 **10c** each or 6 for..... 40c

GENERAL ELECTRIC METERS. 2". D'Arsonval Regular moving coil movement with zero adjuster. Supplied with shunt wire and instructions for converting to any desired DC Milliamp range..... **$1.25**

Filament Transformers

10 Volt 4 Amp Delivers 11 volts at load. Heavy rheostat included with each to adjust to 10 volts. The best way to operate 50 watters for long life. Special Combination Price **$1.10**

2½ Volt 12 Amp For one or two 866s 10,000 Volt insulation Tapped primary..... **$1.25**

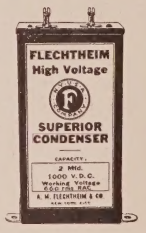
50 Watt SOCKETS—Isolantite Base Double wiping contacts to bottom and side of prongs, nickel-plated. SPECIAL..... **82c**

THORDARSON POWER CHOKE
8 HENRY 400 MA Neatly metal cased; FB for input choke; 3000 volt insulation..... **$1.35**

FLECHTHEIM FILTER CONDENSERS..... 70% OFF

1000 Volts Working—Type HSM

These well known Flechtheim condensers are their Compact Heavy Duty Filter condenser line. Every condenser in this series is conservatively rated at 1000 volts DC. They have a high insulation resistance of over 1000 megohms per mfd, extremely low power factor, non-inductive windings and are made to a capacity tolerance of 5%. Their flash breakdown rating is 3000 volts DC. These condensers need no further introduction to the discriminating Amateur. They carry the full Flechtheim guarantee and are not surplus or obsolete stock. They are brand new.



2 Mfd. — $1.05..... list $3.50
1 Mfd. — 68c..... list $2.25

SPECIAL COMBINATION
2—2 Mfd. and 2—1 Mfd..... $2.80

R. F. Chokes — 500 MA. XMITTING DUO LATERAL WOUND..... 18c

Miscellaneous — Every Price Special

Neon Bulbs. ¼ Watt..... 3 for 50c; 8 for $1.00
Neon Bulbs. ½ or 1 Watt size..... 30c
2½ Volts CT at 8 Amp. Filament Transformer..... 69c
56 Mc. Interruption Coils..... 48c
Soldering Irons, 55 Watt, Good quality..... 70c
DeForest Tubes, type 410, Special..... 73c
Graphite Anode 203-As. A real Husky tube. Fully guaranteed for 30 days. None Better..... $7.95
Magnet Wire, any size 16 to 36, Enam. DSC, DCC, spool..... 24c
Polymet 30 H, 200 Ma. Chokes, 5½ lbs., FB..... $2.45
XTALS, X & Y cut, 80 or 160 meter bands..... $1.55

HARRISON RADIO CO. 142 LIBERTY STREET DEPT. 97 - NEW YORK CITY

ALSO SEE OUR AD ON PAGE 57 — THE SENSATION OF HAMDOM!

ANTENNAS

[*Continued from Page 28*]

all bands. If a single wire feeder is properly adjusted for 160 meter operation, the feeder will be found to have standing waves on it when the antenna is used on the other bands. If tuned current feed is used (same feeders as used with zepp. spliced into center of antenna) the antenna will not work as it should on the higher frequency bands. On 80 meters it will actually work as two half wave antennas in phase, and, if reasonably in the clear in regards to trees, etc., will show some directivity. The angle of maximum radiation above earth will not be lowered as would be the case were the antenna allowed to act as a true full wave antenna.

Another effective "all band" antenna is as much wire, as high and in the clear as it is possible to get, either loaded or series tuned to whatever band you wish to work on, worked against a *good* ground. An antenna of this type, worked on the umpteenth harmonic on 20 meters by the writer, performed rings around a standard horizontal half-wave doublet.

For Just 20 and 40 Meters

If one is interested only in dx. and all operation is on the higher frequency bands, a vertical duraluminum pipe, a half wavelength long, guyed *near* the center with either tarred rope or well-broken up guy wires, makes one half of a good radiating system. The other half is a horizontal half wave doublet, about a half wave above earth, placed as far as possible from its vertical brother to avoid coupling between the two. These antennas can be used either separately or at the same time if the feeders and coupling system are suitably arranged.

If need be, run a feeder a hundred yards or so to get an antenna up on a knoll, so that it "commands the surrounding landscape". If you are pinched for room, or are in a residential district and cannot run feeders all over the place, then the only thing to do is to go *up*.

Without asking us why, you might put a copper ball on the high end of your antenna, or on both ends in the case of a horizontal doublet. Dozens of amateurs swear that it raises their reports from 1 to 2 "R" degrees. Anyhow, it should do no harm, and we have never heard anyone say that it *decreased* his reports.

You have noticed that we have given no attention to exact constructional details in this article. The purpose was solely to attempt to "hornswoggle" amateurs into paying more attention to the radiating system of their transmitters. If you have several hundred dollars invested in the transmitter proper, what if it *does* cost you $50 or $100 for sticks, feeder cable, and other nick-nacks necessary to the hanging of a worthwhile antenna up in the clear where it will do some good? It can truly be said that the antenna system is of more importance than the amount of power used. If we have started you to thinking about this, then we are happy, as our efforts will not have been in vain. But if, instead, you spend $$$ to increase your power from 400 watts to 1000 watts and pay no attention at all to the antenna, you are going to make us very unhappy. And someday a "little" 100 watt station with a real antenna is going to come along and QRM you right off the air. Then it will be time for *you* to be unhappy, and, incidentally, to put up a better antenna.

[Appendix by the TECHNICAL EDITOR]

Hertz Illusions

A number of popular Hertz antenna illusions can stand a bit of exposing.

As a matter of form we will point out once more that "Hertz" is darn well *not* pronounced "hurts". It is approximately "Hairts".

That is incidental; our main concern is with the *performance* of the "Hairts" antennas. When used horizontally, half-wave Hertz antennas are popularly supposed to be very directional—the 20 meter band is filled with discussions as to that topic—and nearly every one seems to think he can "squirt" signals with a mere horizontal half-wave of wire hung at the height of his poles, whatever they be.

Now it is quite true that pronounced directional effects are often encountered when using such an antenna, but it is also true that in many of these cases the directionality is due *nearly 100% to the junk in the neighborhood, and not at all to the antenna.* Most any sort of antenna hung in the same position gives nearly the same directionality when one is surrounded by wires, houses and trees. When a lamp is in a house it can't shine out except through the

windows, and it makes no difference whether it be in a 10c store shade or one bought at a snooty store in New York or Hollywood for 25 times its value—the thing still "gets out" only through the holes in the house walls.

But suppose we *do* have the antenna out in the open. Suppose that marvelously there are no overhead wires within 200 yards, and suppose that all the houses are little and squatty, and well away from the antenna. Even so, is the horizontal halfwave "Hairtz" directional? Not particularly—at least not as regards compass directions.

To support so heretical a doctrine one has but to make a few careful tests in a location where it is fairly evident that any directionality found is due to the antenna and then check them with real beam antennas *at the same location* to make sure that something underground isn't contributing unseen cause of directionality. The results in an "ideal" location will turn out about as shown in figure 1. If the halfwave wire be ¼ wavelength above the true earth, (that is, about ¼ wave above the level at which the permanent water-table takes effect, which is a littel higher than the actual water-table) we encounter radiation somewhat as in the lower row of ink-globs. In the "E" column we are looking at the antenna sidewise and seeing how it radiates endwise, the letter "E" standing for "endwise radiation". The black bar stuck through the lowermost of the "E" blobs is the antenna itself. Note that this endwise radiation pattern does not differ remarkably from the one to the right of it, which is the "broadside" radiation for the same antenna height. In this case we are standing at the *end* of the antenna, which is seen poked through the pattern.

Now—if the "endwise" and the "broadside" radiation are not much different, what's become of our directionality? For practical purposes it "ain't". (Of course at this height the backyard antenna will be in amongst houses and whatnot, hence there will be plenty of "obstruction directionality"—but this is supposed to be an ideal case.) Note, moreover, that the radiation is at nearly all angles upward from the earth, which is to say the thing will work at all sorts of dis-

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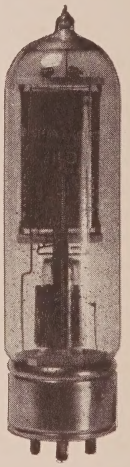
We knew that a price of only $4.90 for brand new, standard, genuine, guaranteed Western Electric fifty watters would make you think, "TOO GOOD TO BE TRUE!" And to question, "What's the catch?" We expected the orders to be worded like a seagoing lawyer's brief. And they were!

BUT HERE'S THE LAUGH!!

After getting their tubes and giving them a stiff test almost all of the boys rushed back repeat orders for one, two, and even three more tubes!! "They surely are FB!", was the concensus of opinion.

MORAL:—

When Harrison offers a value it's not too good to be true but it is too good to last long! So get yours now at the low price!



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These are not 211-E! No RF Chokes in the base! FB for RF!!

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tances for which the frequency used is at all suitable.

Here, then, we have a dilemma. For all-wave *reception* we'd love to use such a pattern, but if we hang the antenna that low we are down in the noise and shielded to boot. We'd like to use such a pattern for transmission to "hit every place", but unless our location is in a 40 acre field our actual pattern will differ sadly from this one.

As a next attempt, suppose the antenna is hung at ⅜ wavelength height. The radiation in an ideal location is then about like the second row of blobs. Since the "E" and "B" blobs are still fairly alike the compass-point directionality is still not worth a postage stamp that has been canceled in the French manner (they seem to use an inked thumb). However, the upward directionality has changed and there is a tendency to favor some elevations, which is, in effect, some distances. For reception this is pretty fair; a halfwave of wire isn't possible for "all-wave" or "all-band" work, but a great many hours of listening and tabulating with antennas of various lengths and heights suggested that a pretty good compromise was a 70 foot wire about 30 feet up in the air, noise permitting so low an altitude.

Next let us take the antenna to ½ wave height. Now the "E" and "B" blobs differ in size by an extent corresponding to about 3 times the power broadside as endwise. That is, if you are in the center of a 40 acre field which has been carefully copper-plated all over its surface. Over actual dirt, in an actual yard, with real houses and undeniable wires all about—anything can happen. It is therefore pretty clear that any conceivable directional effect strong enough to be *heard* will either be an *accident* of location, or else will be the result of getting the antenna out of the mess and at a height something like ½ wave or better.

But there is still a catch. The ½ wave high antenna is quite strongly directional as regards the upward slant of the departing waves, which is to say certain distances can be worked over while others work only if Heaviside accommodatingly hoists his layer to the right height. Very frequently it is found on careful consideration that the refusal of a halfwave horizontal "Hairts" to work into certain countries is due to radiation at an unfavorable angle upward, with compass-point directionality having little bearing. True, a ½ wave high antenna does have a better chance if turned to put its higher-power side toward the untouchable country, but quite often exactly the same result is obtainable by mere raising or lowering of the antenna.

In view of the tendency of these antennas to produce such bothersome directionalities of elevation, except when hung so low as to be screened in average amateur locations, there is ample room for doubt as to their suitablity for average amateur use, where work at random distances and in random directions is desired.

It has been freely asserted in the past that these antennas produce lower losses than others. In an amateur location there is plenty of room to doubt whether that can be demonstrated. Since the ultimate purpose of all sending antennas is to send, the various doubts can all be resolved if enough dx and local sending tests are made so as to wash out the effects of bad observation, interference, fading and the other irregular damnabilities. Such data are being accumulated gradually. Even in the half-wave antenna's own band the results do not favor the horizontal "Hairts" above other and more flexible antennas as regards potluck transmission.

◆

QRG?
A Navy Type Push-pull Oscillator

◆

No

Rumors that *R/9* is about to combine with another radio magazine are at present without foundation, though such an arrangement was once contemplated.

◆

Toledo, Ohio

Sirs:

. . . May I also offer my congratulations on the new and better *R/9?* I think it's very fb and may your shadow never grow less. Many favorable remarks regarding your stand for justice for the amateurs are heard hereabouts.

G. A. Sears, W8LKP

Calls Heard

[*Continued from Page 37*]

sp1dn-3; sp1dt-5; sp1fe-6; su1sg-6; u2ne-5; u3bi-5; u3cy-6; u3di-7; u2qe-4; u4ln-6; vq3bal-6; vq4crl-6; x2c-6; yr5bb-6; zc1ff-5; ze1jn-5. — **ZS** 1b-3; 1z-6; 2a-6; 2x-5; 4e-6; 5a-6; 5d-5; 5u-6; 5x-6; 5z-4; 6a-3; 6af-5; 6am-5; 6b-5. — zt1f-5; zt1r-3; zt6z-6; zt6n-4; zt6w-5; zu1l-4; zu5ac-4; zu5b-4; zu5w-5; zu5y-4; zu6b-5; zu6k-5.

Eric Trebilcock, BERS-195, 2 Henry Street, Maylands, South Australia

January 19 and January 20

(7 mc.)

cm8pq-5; cr7ai-5; ct1bg-6; ct1ed-6; d4bmg-5; d4uao-5; ea1be-5; ea3eg-6; ea5bg-4; g6wy-5; k4rj-5; k6auq-6; k6hlp-7; k6iae-6; k6juy-7; k6kef-8; k6kfb-6; k6lbb-8; ka1ee-7; ka1or-6; ka1sx-8; ka1us-6; pk1bo-8; pk1md-7; sp1oc-5; sx3a-5; u3qe-3; xu8cb-7; vs7ra-3. — **W** 1hpi-4; 1hxw-6; 2aer-5; 2dtr-4; 4aak-6; 4ahy-4; 4cwd-5; 5cxf-6; 5dxp-5; 5ecu-5; 5ejl-5; 6bdd-5; 6cys-6; 6jmr-5; 6ldq-8; 7dnl-5; 8cnz-8; bmqq-5; 9gek-7; 9hge-6.

(14 mc.)

ac8al-7; f7cgv-5; g6wy-5; k6aja-5; om2aa-5; ok2op-4; vp5pz-5; zs1h-7. — **ZL** 1ak-5; 1ao-5; 1hy-7; 2bz-4; 2cw-6; 2kk-6; 3dk-4; 3fg-7; 3gm-6; 3gs-6; 3hk-5; 3hv-5; 4bq-8; 4ck-5. — **W** 4ft-5; 8dye-5.

Julian Pawley, LU1CH, Larrea 36, Buenos Aires, Argentina

January 15 to February 15

(14 mc.)

W 2cgu-6; 6ahz-6; 6bam-8; 6dal-5; 6der-6; 6eek-6; 6fuy-5; 6gh-7; 6ghj-6; 6gkc-6; 6hoc-5; 6jcz-6; 6jfj-5; 6jn-6; 6kby-6; 6khv-6; 6km-7; 6kqn-7; 6kri-7; 6vb-7; 7ecr-5; 7ek-5; 8cra-6; 8cte-7; 9sie-8. — j2hg-6; k6kkp-6; oa4m-4; om2aa-7; vs6aq-5. — **ZL** 1ak-6; 1ao-6; 1hr-5; 1hy-7; 2bz-6; 2cw-6; 2ik-6; 3cp-5; 3dw-7; 3gm-7; 3hk-6; 4ck-6. — zs1h-7.

Stanley Parker, HC2HP, Guayaquil, Ecuador

January 17 to February 17

(7 mc.)

W 4clg-7; 4czr-5; 4dbc-4; 5aro-4; 5xm-7; 8mtm-4; 9dxx-8; 9slo-6. — k5af-7; k5am-4.

(14 mc. phone)

W 1bjz-4; 2zc-8; 5ali-4.

(14 m.c. c.w.)

W 3evr-4; 4bpd-8; 8lea-7. — k5aa-9; k5af-9; k5an-6.

◆

San Jose, Calif.

Sirs:

Congratulations on your fine magazine. I subscribe to the others also but find *R/9* the best along technical and practical lines. . . . Anyone with any horsesense at all can grasp the advantages offered in the political policies of *R/9*. More power to you!

S. Masunaga, W6ALF

The Dow Oscillator

[*Continued from Page 39*]

The numbers above the condensers in figure 1 may be read as micro-microfarads without any great error, though they relate to another unit not used in the United States Amateur's world. None of them are critical.

As to what can be done with a Dow oscillator under favorable conditions, there are several examples on the air in the amateur bands. We hope to describe some of them in *R/9*.

◆

Winnipeg, Man.

Sirs:

. . . upon reading the article *A Promising Plan* in the March issue by the I.R.F., I could see in every line "for the good of the amateur". I think it is a grand idea and should be headlined in coming issues of *R/9*.

Harry L. Eddy, VE4KX

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Open Forum

[*Continued from Page 44*]

really officers with the true status of paid employees. And as Mr. Warner, the secretary, acts as general manager, one can wonder about the independence of the treasurer and communications manager in their committee actions.

Annually we are treated to the report that the directors met and ratified all the actions of the executive committee. They do not have to, it's true. But faced with accomplished facts what else is there to do without undoing endless detail and enduring mutual embarrassment?

The importance of some of the Executive Committee's actions is shown in recent elections in which one candidate, because he is a QSL-card printer, was refused permission to run, while two directors have been elected who are employees of the A. T. & T. Co. No doubt the latter are non-radio help, but few organizations have such a large stake in radio facility assignments as American Telephone, and it is a radio manufacturer through a wholly-owned subsidiary.

These two directors will be uncomfortable in any commercial radio-amateur clash.

L. S. HILLEGAS-BAIRD, ex-9HO

Another important difficulty in the way of more frequent meetings of directors is the time demands made upon those who must travel farthest. This objection can be partially met by the use of air travel and the moving of headquarters to its logical location somewhere between the geographical center and the center of population of the country.—EDITOR

◆

Shaker Heights, Ohio

Sirs:

. . . Incidentally, the character of the technical articles in both *R/9* and *Radio* is splendid, in my opinion. Constructional articles can be very brief and general with regard to mechanical details because most hams will have to work out the details for themselves in order to get the parts on hand to fit where some other shape or size was used by the author. On the other hand, the real merits of the particular arrangement of equipment used should be given plenty of space. Perrine's article on page 15 of the November *Radio* is an example of a short but lucid constructional article.

RICHARD S. ROBERTS, W8MVM

◆

Ann Arbor, Mich.

Sirs:

. . . I hope that you may enjoy reading this clipping as much as I enjoy your *R/9,* which is certainly the finest magazine there is in amateur radio. . . .

FRED L. ARNET, W8LLK

DX Notes

[*Continued from Page 29*]

a postal regulation prohibiting the issuance of station licenses to applicants under the age of 16, Madeline is without a station call. Special efforts are being made to make an exception to this rule, and the call VK4YL is being held open in case the attempt is successful.

◆

Bart White, VK5PL, announces the arrival of a new o.m.

◆

VQ4CRL is on 14,200 kc. phone and would like to receive reports from anyone hearing his signals.

◆

VQ4CRO reports very irregular reception this year on 14 mc. At times the band is completely jammed with "W" signals with an almost total absence of "G" stations. It is expected that in the future conditions will be reversed as indicated by a gradual falling off in "W" signals.

◆

May Mann of Semaphore, South Australia, will send direct verification to any stations listed in her reports. She may be addressed at 24 Newman Street.

◆

CT2BK sends along his congratulations to the United States amateurs for the notable improvement in the quality of their signals. About 95% of the signals received are CC T9, and it is a rare thing to hear anything less than a T8. Perhaps the pink slips are scaring the r.d.c. sigs from the band. At the present time Europe is far below the "W" standards. The CT2BK report states that Spain has some of the best and some of the worst signals on the air. France is showing a marked improvement, while Switzerland is now 100% crystal control. English stations are c.c. but keying is not always clear, probably due to b.c.l. suppressing devices which give a "bell like" tone to the signals.

The familiar signals of Henry Smith, CT2BK, will no longer be heard. He is packing up and returning to New York.

◆

Wauwatosa, Wis.

Sirs:

. . . You certainly deserve every compliment for the magazine you are now putting out, and I hope the good work keeps up. . . .

LOUIS A. WOLLAEGER, W9ANA

Two Letter Calls

A big, chromium plated gas eater slips around us doing 70 or 80 m.p.h. We get one swift glance at the license plate; it is "2A7". Or maybe it is "5Z3". Anyhow, we sigh and wish that we, too, could rate a low license number. Foolish? Yes! It merely means that the owner "knows the right people and pulls the right strings"; yet we attach to it an unwarranted distinction. In fact, a low license number, from one standpoint anyhow, would actually seem to be *undesirable;* it is much easier for a cop to remember or to read from a distance (though unfortunately he, too, may be influenced by a low license number—we once heard a certain motor cop say that he had "great difficulty seein' numbers with less than four characters" . . . perhaps the reason he had held his job so long).

What have low license numbers to do with amateur radio? Just this: the average amateur is just as childish about sporting a two-letter call as John Jones is about flashing a low-number license plate. A little common sense will tell us that the only reason a two-letter call should be more desirable than a three letter one is that it is usually slightly easier to send. But that is not the reason Willie Doaks wants a two-letter call; he probably doesn't even take that into consideration. W4EEE is easier and quicker to send on c.w. than W4JJ. But just give him his choice and watch how fast he picks W4JJ.

Now wouldn't it be a good idea, so long as we have, for no particular reason, placed great significance upon two-letter calls, to work out a scheme whereby two-letter calls (not now in use or hereafter surrendered) would be issued in recognition of some particular record, accomplishment, or achievement, instead of being issued indiscriminately?

When calls were issued from the different inspection districts instead of from Washington, a two-letter call often meant a box of cigars or candy for the clerk in the office. Did you ever notice how much higher the percentage of two-letter calls runs in San Francisco than in Los Angeles among hams that have been on the air for a few years or so? This is *not* a criticism of the executives of that office at that time. Such practices are bound to occur where the subordinate help is easily "reached".

Now that our tickets are issued from Washington and such "goings on" are much less likely, it should be possible to put such a plan into effect.

The question arises: how would the eligibility and qualification requirements be determined and by whom? If the amateurs are sufficiently in favor of this plan really to want it put into effect, the details can be worked out later. If you have any opinions on the subject we would be glad to hear from you.

The following are examples of what might entitle one to a two-letter call: *activity* on the air for over 10 consecutive years; technical development of great value to amateur radio; winner of important officially sponsored contests; perfect copy of both NAA and NPG on Navy Day honor roll; QRR work of great importance or where operator risks life or voluntarily endures physical suffering to handle QRR traffic; and the like, perhaps including WAZ.

True, many of the present holders of two-letter calls would not qualify and there would probably be a terrific "squawk" go up if an attempt were made to recall the two-letter calls issued to those not eligible under the new arrangement. So let the plan affect only calls issued in the future. Ten years from now practically all of these still possessing their licenses will automatically qualify under the "old timer" heading.

If you are enthusiastic over such a plan, let us know. If the amateurs of this country should be unanimously in favor of such a plan, we feel sure that the F.C.C. would coöperate to the extent of issuing two-letter calls to those amateurs approved by the official committee.

Let us have your ideas on how the committee should be appointed, by whom, what the qualifications should be for two-letter calls, etc.

◆

Hot Springs, Ark.

Sirs:

. . . I subscribe to *R/9* but my February copy was stolen. Hi! Please rush another copy as I am going to build a circuit illustrated in that issue.

By the way I might add that *R/9* was in the car with four other very prominent and popular magazines, but the thief left the rest, taking *R/9* only (we saw the thief running. Hi!).

WAYNE CHITWOOD, W5DYT

. . . Exacting

Scientific Radio Service Crystals are prepared so that they have but ONE constant frequency and will maintain this frequency as long as the operating temperature remains constant. We pride ourselves with the fact that our aim is toward "QUALITY" crysals rather than Quantity.

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◆

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New Receiving Antenna

How an antenna can be aimed into a beam of radio waves and made to select a single component was described by Messrs. E. Bruce and A. C. Beck, engineers of the Bell Telephone Laboratories, at a meeting of the Institute of Radio Engineers, April 3, 1935, at the Engineering Building, New York. In their passage over long distances short radio waves are separated into several beams which often interfere with each other and cause fading. These separate beams result from the many reflections between the earth and the electrified layers of the upper atmosphere, which the radio wave experiences as it is being transmitted from the sending to the receiving station. This splits the original wave into a number of separate components which arrive at the receiving station at slightly different times and from somewhat different directions. If only one of the several components is picked up fading can be very much reduced. Experiments which Msesrs. Bruce and Beck have made show that by using an adjustable antenna it is possible to segregate one of the beams from the rest and thus improve the clarity of reception. The antenna used consisted of single strands of wire connected in the form of a diamond 600 feet on a side.

◆

Radio Philatelists

A number of suggestions have reached us that *R/9* establish a "radio philatelist" department. Yes, Alphonso, a philatelist is a stamp collector. How many radio amateurs are collectors? Let's hear from you. Though the editor pursues both hobbies, the connection between the two so far escapes him. However, if enough readers are interested, we'll be glad to "take a crack" at it.

Other radio philatelists may be interested in the R.S.G.B.'s *Philatelic News* at 2/6 per year from M. W. Pilpel, 7, Woodbury Down, London, N. 4, England.

◆

One ham we know had his 66's ruined when the line voltage failed for a few seconds several times in one week. The line voltage stayed off just long enough for the 66 filaments to cool but not long enough for him to realize what was happening and throw the switches. When the voltage would come on, the plate voltage would come on immediately, the filaments lagging several seconds behind. Believe it or not, when the ham good naturedly joked about the incident to the manager of the power company, they went out and bought the amateur a brand spanking new pair of 66A's.

Who sez there "ain't no Santy Claws"?

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OSCILLATIONS

Glendale, L. I., New York

Sirs:

. . . Keep up the good work and help the "hams" rub the sleep from their eyes.

CLIFF E. FRIEND, W2HDK

◆

Colorado Springs, Colo.

Sirs:

Right off the bat, let me congratulate you on the very excellent magazine you are turning out now. I rate *R/9, Radio,* and *QST* as equals . . . and that means plenty, for I have a very high regard for the A.R.R.L. and its *QST*.

One thing gets into my hair . . . and I believe that you are fair enough to admit that it is darned poor sportsmanship. It's this: Why do you continually harp on and make dirty cracks about an alleged tie-up between *QST* and some of its advertisers (National, Cardwell, etc.) and yet never say a word about the most gosh-awful example of that so-called evil that exists in *Radio?* Their tie-up with the United Transformer Corp. and with The Wireless Shop are the most flagrant that I have ever seen. If you are going to roast one competitor, why not pour it on the other, too?

CARL C. DRUMELLER, W9EHC

The company publishing *Radio* is a private business; as such, its activities are none of *R/9*'s business so long as it doesn't tread on *R/9*'s toes.

Not so with *QST*, which is very much the business of all members of the A.R.R.L. Small interest as a magazine has *R/9* in *QST*'s advertising tie-ups. Much interest have we as amateurs in tie-ups which might on occasion enable one commercial concern to bring undue pressure upon A.R.R.L. officials to the possible detriment of amateur radio.—EDITOR.

◆

East St. Louis, Ill.

Sirs:

. . . I am certainly glad to see the "Open Forum" back again, and enjoy it very much. I heard —— speak in St. Louis last week and can now realize why [his organization] is losing prestige so rapidly these days. The place of the best and leading amateur publication, if you can stand a bouquet, is now occupied by *R/9*.

Of forty-five licensed hams in East St. Louis, six are members of the League. "Of, by, and for the amateur, it numbers within its ranks," etc. Phooey! . . .

EARL R. LINDER, W9DZG

That no stone be unturned in the fight for more frequencies, we hope all good amateurs will not only work direct on political officials, but also indirectly, by joining and reforming the A.R.R.L. to the end that it acquire able, aggressive, fighting leadership.—EDITOR.

◆

Rockford, Ill.

Sirs:

. . . . You have published several articles on various subjects which I had not been very successful in finding any information about. Keep up the good work. . .

JOHN ALEXANDER, JR., W9GXQ

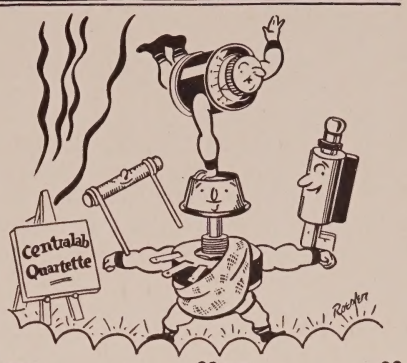
◆

Honolulu, T. H.

Sirs:

Having read your *R/9* and also —— for a year, I am more than pleased to read it another year or more; it sure contains more dope than any one of the magazines ever published in the line of short wave radio.

HARRIS TARUMOTO, K6ESU



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AN INEXPENSIVE PREAMPLIFIER

Several years ago Paul Mueller showed us an ingenious way of working a push-pull "power" audio stage, using 250 tubes, with only two tubes, and triodes at that, between it and a *condenser* phonograph pickup. The fidelity was better than that of many home-made amplifiers.

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The idea is this. One makes up a small oscillator using a d.c. tube, preferably a 112A. The grid circuit is tuned by the capacity of the condenser mike which is connected across it without the usual "polarizing" battery. The plate circuit goes from a plate through a tickler, then through one 45-volt B battery block, through the primary of a *good* audio transformer, and so to the filament. Both battery and transformer are bypassed by a .0005 mica condenser—more if you don't mind losing some highs. Adjust grid and tickler turns until the tube oscillates steadily at almost any wavelength between 200 and 500 meters—but don't accidentally tune to the local B.C. station or they may be relayed unintentionally! The grid coil has its lower end returned to the negative filament terminal.

Put a d.c. milliammeter in series with the B battery and talk to the mike. The meter should not show much interest if the oscillation is constant, though the frequency is being "wobbulated". Now wind on the same coil-form another coil which can be tuned to resonance with the oscillator. Adjust its position so that the tube stops oscillating over about a 10-degree portion of this condenser's dial. Feed the transformer output to one audio stage and listen with a headset while the mike stands in front of a b.c. receiver's speaker. Then turn the variable condenser through the non-oscillating position and seek the setting on one side of it which gives the best audio output—"best" meaning just that—not greatest. That's all.

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THE BEST place to buy anything in radio, Palmer's Trading Post, Route One, Duluth, Minnesota. Trade in your old receiver for any make. Finest AT crystals $2.50, 80 and 160 band; "X"-cut, $1.65 for 80 and 160 band. 40 band, $2.00. 5C demonstrator, $62.50.

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R/9

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THE *Crystal* CONTROLLED 7-TUBE SHORT WAVE RECEIVER

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